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The Tariff and the Electrical Industry

The new tariff bill is of interest to the electrical industry because national legislation on this subject may affect prosperity. There is a possible direct effect on manufacturers through the encouragement presented to foreign makers to compete in home markets. There is a possible indirect effect from disturbance in the general business situation of the country. While there may be isolated cases where the effect of competition from foreign makers will be felt, we believe that they will be few in number and negligible in comparison with the great totals of output of electrical machinery and apparatus. In other words, so far as the whole electrical manufacturing industry is concerned, the direct effect will not be appreciable. The manufacturers have long known that changes were coming and they have shaped their courses to that end. It is less easy to predict the effect of the law upon general business conditions and through them upon the electrical industry. If industrial paralysis should develop, of course, the effect would be felt by all lines of activity. However, dire suggestions are not justified. The Washington government is trying only to reduce the cost of living for the masses, and it realizes as keenly as anyone else that it cannot do this by destroying business. The strong safeguard of the electrical industry is its great diversity of application. Its foundation on this rock supports it creditably when general trade conditions hesitate. Certainly while the country lives and progresses there is no reason for gloom, and there is reason to believe that the electrical industry will do as it has in the past, continue to make steady strides toward a still greater future.

Studying the Electric Sign

Few energy-consuming devices will better repay initial study at present than the all-conquering electric sign, and particularly the sign of the fixed type. In many towns the idea seems to prevail that any bell-hanging electrician or tinsmith can design and build a sign which will easily meet a wide range of service requirements, and as a result of this notion the fair face of the land is not seldom encumbered by hybrid installations which are not only ugly by daylight but which violate all the commandments of illuminating engineering by night, and at the same time break through the canons of sound mechanics by their inferior type of construction. As in most other matters, the production of an efficient, safe and effective sign is a problem for fairly expert treatment. Such questions as the location of outlets, the supply of energy, provision for replacing burned-out lamps, support of the sign structure, ease of erection, concealment of lamps in reflector types of signs to avoid glare, reduction of fire risks, protection of leads and sockets from the weather, use of templets in drilling outlet holes, accessibility for repairs, and relation between lamp spacing and legibility at stated distances, need to be worked out by more experienced heads and hands than can be found in the ordinary tin shop. Competition is close in this field, and the exaction of thorough mechanical standards by the central station, combined with pretty severe electrical inspection, will gradually rid the industry of inferior equipment which is of doubtful benefit to the cause of permanently successful display lighting.

Intolerable Vandalism

As a result of labor troubles, important telegraph cables have been cut in Chicago and the transmission lines of the Pacific Gas & Electric Company have been severed. The frequent recurrence of vandalism of this character has reached a point where it involves danger of serious interference with some of the most valuable services furnished by private investment for public use. The telegraph and the telephone rank next in importance as means of communication to the United States mail service. Whenever occasion arises, the United States government takes rigorous steps to avoid interference with mail service, and the question of whether a federal statute should not be enacted authorizing the government to take similar steps in the event of interruption of telephone, telegraph and electric service is worth careful consideration. Whole communities are dependent on transmitted electrical energy for lighting, railway and industrial service, and municipalities employ it for pumping water and other purposes. These facilities, although owned and managed by corporations subject to public control instead of directly by the public, are necessities of home and business life, and interference with them means distress and loss that should not be tolerated.

The Arc as a Light Standard

Mr. Forrest's British Association paper, abstracted elsewhere in this issue, represents an interesting study of a difficult matter. To secure such uniformity in the crater of a carbon arc as to give it even a remote claim to consideration as a standard of light is in itself a formidable task. The platinum standard, abandoned as impracticable by general consent, involves less of practical uncertainties, yet so carefully has Mr. Forrest worked that he has been able to secure reasonably precise results even when utilizing a rather wide range of current in the arc. At a certain current density the crater seems to reach what is practically the boiling point of carbon and to remain at this temperature under rather uniform average conditions. The crater sur-

face, indeed, is not of the same brilliancy all over, yet upon the whole it gives a remarkably steady light when formed in a uniform and exceptionally good grade of carbon. Considered as a light standard the source is practically a carbon surface at its vaporization temperature shielded by a Methven screen of very minute dimensions.

The last-mentioned feature seems to be the really serious objection to the arc as a light standard. Under uniform conditions one may be able to obtain great steadiness, as the experiments well show, but the apparatus appears to be of dubious value with reference to reproducibility that is so vital in a primary standard. The area of the screen in this case is well below 1 sq. mm, and hence even the minutest variations in the real or effective size of the hole become significant. With so small a screen hole, corrosion, dust and variation of reflection from the edges rise to importance, as do also probable variations in the actual size of the hole at the start or possible variations in its distance from the floor to the crater. Apparently the device will serve better as a powerful secondary standard than as a primary standard in which reproducibility and certain regularity in action are of fundamental importance. In the former rôle it may prove quite useful.

Hydroelectric Energy for Massachusetts Railways

Elsewhere in this issue is given an account of the extensive use of hydroelectric energy on the Worcester Consolidated Street Railway system, which covers a large part of east central Massachusetts, supplying the needs of local and interurban transportation in an area of some 1200 square miles. The article is of interest to our readers chiefly on account of its illustration of the possibilities of hydroelectric service in a growing system covering many municipalities and facing the limitations of economical steam-plant generation at most points formerly devoted to the production of "home-made" electric energy. The Worcester County industrial situation has literally been revolutionized by the entrance of the 66,000-volt lines of the Connecticut River Transmission Company into this district, and the large energy consumption of such an electric railway network makes the system a desirable customer for the supply company, especially as the demand for service extends over about eighteen hours of each day.

The installations described clearly show the comparative ease with which energy distribution for electric-railway service may be handled. In fact, it is little less than surprising how extensive an area can be served in country districts by one or two 300-kw rotary-converters. The contrast is striking between a compact substation, often requiring only two or three attendants on its payroll, and the small, complicated and comparatively inefficient steam generating station which such an installation supersedes. In fact, the labor cost in some of these installations is almost nominal, since they are combined with the large substations of the Connecticut River company and receive such attention as is needed from the regular operating force on duty in the latter.

Among the interesting features are the enlargement of the railway company's turbine plant at Millbury, the establishment on a neighboring site of a switching station which is now the operating center of the entire Connecticut River transmission system, including the control of 66,000-volt lines from Vernon, Vt., and of lines built for 120,000-volt transmission service from the plants in the Deerfield Valley of western Massachusetts planned for ultimate extension to Providence, R. I., and the use of 2000-kw, 60-cycle rotary converters in the Madison Square substation of the railway company. The design of the Millbury switching station, which is one of the largest of the outdoor type thus far completed in the East, affords an interesting illustration of the requirements of modern extra high-tension control. The tying together of the systems through a frequency changer at Millbury is also a feature of note, but one cannot help wishing that the Millbury turbine plant might originally have been designed for 60-cycle service in the interests of greater flexibility of operation.

Confusion in Nomenclature

The committee on nomenclature of the British Association for the Advancement of Science is a distinguished body, and its suggestions are therefore worthy of serious consideration, but we shudder in contemplation of the results that would follow if every national scientific body should do as it has done recently. It is really a pity that with a carefully organized international body striving to bring order out of chaos and to secure uniformity in at least a few simple matters any national body whatever should think it expedient to introduce conventions of its own. The system of symbols proposed by the British association is not greatly different from that adopted by the International Electrotechnical Commission. It merely varies enough to be confusing at times without thereby gaining in any material particular. The British proposals for symbols are based on the fiction that total quantities and their differentials should be designated by the same letters but in different type, while the I. E. C. scheme makes this same distinction between correlated electric and magnetic quantities. Now, in this whole matter of units and symbols the one thing practically important is that fundamentals all over the world should be expressed in exactly the same terms. It does not make the least difference whether a consistent theory or any theory at all lies behind the international conventions. In fact, as a rule the same general theory of construction would not hold in different countries taking different viewpoints and with mnemonic values never coinciding. It was an immense stride forward when I became the symbol for current and R that for resistance, thus breaking through the international wall. But two Phœnician characters would have done as well, if not better, once they were really put into use.

The trouble at the root of the whole matter lies in a certain selfish indolence that impels those who write or lecture on technical topics to avoid writing or speaking a few plain words at the cost to the world of forcing tens of thousands to think about and learn a new word and a new notation, for which there is no real use whatever. In fact, the British association committee frankly notes that

there are several derelict names which could advantageously be dropped. Even with the elimination of freaks the number of things to be named or noted in allied sciences rises to a figure inconveniently great. The fact is that there is genuine need for fully twice the number of letters available for symbols, even in two fonts of type, when one eliminates the letters already pre-empted for the connotation of general conventions.

The remedy for the present confusion, it seems to us, is twofold. First, avoid special names and symbols unless they are really necessary to large branches of science or technology. It is not sufficient that they should save the lecturer's fingers from wielding the chalk ten extra minutes per year. Second, use not only the Roman characters in two fonts well distinguished, but use the Greek letters, and if necessary others, more freely than at present. Besides, we have subscripts to fall back upon in case of need, and these are especially useful in noting correlated ideas. The chief thing, however, is to stop making futile efforts at a correct theory of notation in favor of establishing international practice. We hope that the British association report will be for all practical purposes laid on the table until the next I. E. C. meeting and will then be amended to agree therewith, so that it may not further confuse scientific literature. A few books printed in an unusual or experimental notation constitute an international nuisance until they are out of date and forgotten.

Interest Rates for Electrical Capital

As a result of conditions in the money market that are felt by all borrowers, high rates of interest on new loans are now being paid by some of the public-utility operating and holding companies. Taking the nature of the loans into consideration, the rates are not out of proportion to those open in these times to older established properties in other lines of industry. Some of the capital issues are offered for public sale by bankers at a net interest yield of about 7 per cent. Of course, the full cost of the money including the discounts of underwriters and incidental expenses connected with financing is higher than the net yield to public retail buyers, but it is doubtful if borrowers representing new companies in other avenues of industry could obtain capital on terms as advantageous. The new consolidations in the electrical industry have a standing as borrowers that is colored by the fact that they are composed of tried operating properties with an established business to which the benefits of combined production and management are to be applied. It is true that no one can foretell accurately what the saving in the cost of production and total operation will be when a single operating unit takes the place of many separated units. Neither can any one prophesy infallibly as to the additional amount of business obtainable in a given territory by the introduction of advanced commercial methods of sale to supplant indifferent methods, but it is a material consideration.

The economic advantages of a consolidation of electrical plants appeal to bankers, who realize the profitable possibilities in such situations. The bankers, however, are really agents in the transfer of the obligations or stock of a public-utility company from that company to the permanent holders, the investing public. They make large profits on some transactions, particularly when an unexpected change in the money market or the public demand for securities enables them to mark up prices so that their margin of gain is increased. In all their transactions, however, they are guided by the temper of the investing public, which always has the last word. If the public cannot be tempted to buy except by offers of securities yielding uncommonly high rates of interest, as at the present time, the bankers in turn buy cautiously and only such securities as they feel will "go" quickly. They do not desire to hold the securities for a long time; they are merchants, not investors.

In view of the conditions which have generally governed the 1913 money market, it is clear that a large amount of public-utility financing is awaiting the restoration of a normal absorbing demand for securities. Some of the companies have provided for their needs by the issue of stock at par when this meant rights of material value to their shareholders. Others have declared stock dividends as a means of capitalizing accumulated surplus. Either of these means, or the similar one of an increase in the dividend rate if such action is warranted, is likely to attract and retain public interest in the stock. Perhaps a resort to a reasonable step of this character is not criticisable when one considers the fact that, if it is done in a period of tight money and is justifiable, the company is likely thereby to improve its standing with stockholders and therefore its general credit position. Certainly at such a period borrowing through the usual banking channels is difficult and expensive; and if the stockholders can be used in reasonable ways to better the credit of the company or to provide the funds for the necessary capital expenditures by subscriptions to new stock issues, the interests of the company are well served.

Companies that have not been able to meet their capital needs by the issue of securities but have had to borrow moderate amounts of money have done so largely through their local bankers. Although the discount rates on such loans are high now, local bankers usually provide the best means for temporary financing, provided, of course, they are sufficiently interested in the property, either financially or because it is a local enterprise, to protect it until such time as permanent financing can be arranged. It is wise, of course, for the company to restrict its capital expenditures, if possible, so that the banker may be able to protect not only it but his other customers. If the loans become so large that the utility has to deal with outside lenders of money, it is likely to find that its temporary financing is attended with greater expense than it thought possible. Ordinarily the operating central station can control satisfactorily the main part of its capital expenditures, so as to avoid undue commitments in an inopportune borrowing season, but an extensive program of reconstruction requires capital at whatever price the market may exact. One act of borrowing by the issue of long-term bonds, if they are salable, is much cheaper than several loans at equivalent rates because of the difference in the banker's commissions involved. On account of this fact much permanent financing will be postponed until conditions change so that the lender, instead of the borrower, is the seeker.

The News of the Week

Activities and Events in the Electrical Field—Reports of Meetings—Commission Findings, Etc.

Cleveland Bonds for Municipal Plant Held Valid

The Ohio Supreme Court has decided that the city of Cleveland may issue bonds for the construction of a municipal light plant. A suit to test the validity of the bonds was brought some time ago by a man connected with C. A. Otis & Company, a bond house in Cleveland, and the decision was handed down in this case.

The sinking fund commission of the city of Cleveland has purchased $200,000 of the bonds, and this will enable the city to proceed with the construction work on the plant. It has been delayed because of the litigation over the bonds.

Large Hydroelectric Plant for Connecticut Valley

The Turner's Falls Power Company is planning to build a 50,000-hp hydroelectric station at Montague City, Mass., within the next few years. The initial development will total 30,000 hp and is to be completed early in 1915. The plant will cover half an acre of ground and will utilize water from a canal 1.5 miles in length, requiring the excavation of 500,000 cu. yd. of material, of which 100,000 cu. yd. will be rock excavation from a ledge 30 ft. to 50 ft. deep. William B. Durant is in charge of the engineering for the Turner's Falls company.

Boston Electric Motor Car Club Election

The Electric Motor Car Club of Boston held a regular meeting on Sept. 24 at the Engineers' Club, at which the nominating committee reported the following list of officers for election at the annual meeting: President, Mr. Day Baker; vice-president, Mr. E. S. Mansfield; treasurer, Mr. J. S. Codman, and secretary, Mr. L. L. Edgar. Following the usual luncheon it was announced that in the coming spring the club will entertain a delegation of European electrical men by electric automobile trips in eastern Massachusetts on the occasion of the convention of the Association of Municipal Electricians at Boston. The annual meeting of the club will be held on Oct. 8 at the Hotel Thorndike, Boston.

Possible Use of Oxygen in the Fixation of Nitrogen

During a lecture on "Liquid Air and Its Uses" delivered before the recent International Congress of Refrigeration at Chicago, M. Georges Claude, of Paris, described the method of producing oxygen by the liquid-air apparatus. He told of various uses to which the oxygen could be put, as, for instance, the cutting of metals. Oxygen appears also to be on the eve of entering the field of another great application, according to Mr. Claude, and that is the fixation of nitrogen. The manufacture of nitric acid by the electrification of the air is done on a large scale in Norway by the company that is exploiting the patents of Birkeland and Eyde. The author said that more than 200,000 hp is at present employed in the manufacture of nitrate of lime needed for agriculture. He continued: "Now in regard to the product NO, which we are concerned in obtaining, the air which we electrify is a dilute product. If in place of air we electrify a mixture of air and oxygen, corresponding exactly to N_2O—that is to say, if we electrify air with 50 per cent of oxygen—theory and experience agree in finding that the formation of nitrous vapors will be much more abundant. The improvement will be, without doubt, to the extent of 30 per cent, and the cost of manufacturing the oxygen will absorb but very little of this improvement."

Plans of Commercial Section of the N. E. L. A.

The executive committee of the Commercial Section of the National Electric Light Association will hold a meeting at the associaton headquarters in New York on Oct. 16. In laying plans for the work of the section at next year's convention in Philadelphia it has been decided to limit the number of papers to be presented at a session to two, so that ample time will be given for discussion. Moreover, the papers will be very broad in scope so as to cover the commercial work of the entire central-station industry regardless of the size of the company. It is expected that by Jan. 1, 1914, the revised edition of the "Electrical Solicitor's Handbook" will be issued. The revision will be in the shape of detachable leaves to be issued quarterly and contained in a leather binder. Included in the work will be data heretofore appearing in the "Digest." The work of revision is now in the hands of experts in lighting, heating, cooking, industrial applications of motors, etc.

Non-Political State Commission Requested

At the meeting of the Electric Club of Chicago on Sept. 25 Mr. Samuel Insull was the speaker of the day. In opening, Mr. Insull dwelt on the enthusiasm with which young men are solving the problems in the electrical field. But in the end, whatever electrical men may do, the prosperity of the industry as a whole depends upon the success of the consumer. No doubt great economies are possible through the concentration of production, and this phase of the industry is being rapidly developed.

Financial conditions during the last year have made it difficult to secure new capital for development work. Consequently development has been retarded, but the electrical industries have not felt the restraint as much as other sound legitimate propositions. Conservative proposals for the development of electrical industries have met a more ready response than others of equal merit.

Mr. Insull, in discussing the political situation in the State of Illinois as regards public utilities, said that there is a possibility of serious conditions arising in the near future, owing to the public utilities law placing under the control of the Governor all the public utilities in the State. Unless great care be exercised in making the appointments to the Public Utilities Commission of the State, with a view of protecting not the public alone but the utility companies as well, a turmoil, he said, is certain to result. If the appointments are made on a basis of political reward, it will result in great harm to the utilities of the State. The speaker declared, however, that he had confidence in Governor Dunne and felt sure that he would exercise good

judgment and appoint men of fairness and ability, and thus make the law a benefit to all concerned. Owners and operators of public utility properties stand ready to do all in their power to make the commission a success, and it is to be hoped that the quality of men appointed will be such as to make co-operation possible.

Mr. Bion J. Arnold followed with a few remarks and went on record as favoring state commission control if the commissioners will not lose sight of the fact that the investor must not only have a fair return on his money in so far as it is evidenced physically, but also a fair promoter's profit.

Meeting of New York Section, A. E. S.

The first meeting of the season of the New York Section of the American Electrochemical Society will be held at the Chemists' Club Oct. 17. The subject for discussion will be "Some Applications of the Microscope to Industrial Work," and the program is as follows:

"Metallography of Carbon": The application of the principles of metallography and petrography to the identification and analysis of carbon products, showing the development of characteristic structures and the utilization of these structures in identification and analysis. By Mr. G. A. Roush, assistant professor metallurgy, Lehigh University.

"The Microstructure of Raw and Manufactured Copper": A series of pictures showing structure of cast copper and how this structure is altered by rolling, etc. By Mr. W. H. Bassett, technical superintendent and metallurgist of the American Brass Company.

"The Microscope in Mineralogical Analysis": A series of Lumière plates showing microphotographs of zinc ores with resolution of the minerals present. By Mr. Gilbert Rigg, research engineer of the New Jersey Zinc Company.

"Some Remarks on Micrometry as Applied to Alloys": The use of micrographic methods in investigating questions of constitution, qualitative and semi-quantitative interpretations; structural relations which are favorable to the development of micrometric methods; advantages and shortcomings of such methods in ordinary analytical practice; the determination of cuprous oxide in copper and of iron in zinc. By Dr. C. H. Mathewson, assistant professor chemistry and metallography, Yale University.

Preparations for the Chicago Electric-Vehicle Convention

As enumerated in the *Electrical World* of Sept. 27, page 617, there will be ten or eleven papers presented at the annual meeting of the Electric Vehicle Association of America, to be held in the Hotel LaSalle, Chicago, on Oct. 27 and 28. These, with the presidential address of Mr. Arthur Williams and other business that will come before the meeting, will be considered in four sessions, one each in the forenoon and afternoon of the two convention days.

A well-attended, snappy convention is anticipated. It is expected that about 100 visitors and guests will attend from New York and its vicinity and about twenty-five from Boston. The attendance from Chicago and other points in the Middle West will be large. The New England Section of the Electric Vehicle Association has appointed a Chicago convention committee consisting of Messrs. Day Baker, J. S. Codman and O. G. Draper. Mr. F. N. Carle, of New York, and Mr. C. B. Frayer, of Chicago, are looking after the transportation arrangements.

Convention sessions will be held in the Red Room on the nineteenth floor of the hotel. The eighteenth floor will be devoted largely to exhibits. At 6 p. m. on Monday, Oct. 27, visitors and invited guests will be entertained at a beefsteak dinner given by the Chicago Section. At 8 p. m. there will be an automobile parade during which the visitors will be taken to inspect South Side electric garages in Chicago. Returning to the hotel at 10:30 p. m., the convention party will be entertained at a vaudeville show in the Red Room. On Tuesday noon the members of the association and others will be the guests of the Commonwealth Edison Company at a luncheon at the Hotel LaSalle.

Uniform Electric Rate Association

A committee appointed by manufacturers of apparatus for isolated power plants has formed the Uniform Electric Rate Association and has issued a circular calling attention to the purpose of the movement. The first annual meeting of the association will be held on Oct. 20, 1913, but the meeting place has not yet been determined. At this session it is proposed to elect officers and frame a general policy for the work of the association.

In connection with the call for the meeting, the association has issued a pamphlet giving the legal opinion of Mr. Louis D. Brandeis, of Boston, Mass., on the subject of central-power-station rates. Mr. Brandeis discusses in his opinion the subject of variable rates and points out various court decisions bearing on the matter. He specifically answers questions based on the statement that there is a general movement in this country to secure for some electric light and power company of each city a substantial monopoly of the electric business in that city.

Mr. Brandeis declares that, assuming that there is a difference between the cost of energy for the wholesale and the cost for the retail consumer, a public-service corporation can, in the absence of any statute regulating or limiting the price at which it shall be sold, make a higher price to the retail consumer, but the difference in the selling price may not be substantially greater than the difference in cost.

Boston Development Association Disbands in Favor of National Body

Owing to the fact that the Society for Electrical Development has been incorporated and is now being underwritten by subscriptions from the electrical industry at large to carry forward and accomplish for the entire country what it was proposed by the Electrical Development Association of Boston, Mass., to do for New England alone, the latter body has voted unanimously to discontinue further activity as an association. The executive committee of the association feels that the national movement in its broader and larger spirit of co-operation merits the support of the electrical industry of New England as well as elsewhere and in notices to its members urges them to lend their support to the national movement.

New York Electrical Show

The Electrical Exposition and Motor Show to be opened at Grand Central Palace in New York on Oct. 15 is to be primarily of an educational nature, and each display is being arranged with an eye toward teaching the visiting manufacturer just how much he is sacrificing by not adopting electricity as his motive power. The motor vehicle is to have a more prominent place than ever, and arrangements have been made to devote almost an entire floor of the palace to the electric automobile manufacturer. One of the features of the exposition will be an "Electric Farm" occupying 90 ft. or more of show space and including every kind of farmwork into which electricity has been introduced. Two interesting canal displays have been arranged. One, provided by the State of New York, is a

large model of the siphon locks on the Barge Canal. In connection with this motion pictures of the canal in use will probably be displayed. The other canal exhibit is a 20-ft. by 4-ft. model of the Pedro Miguel locks of the Panama Canal. There are a variety of other government exhibitions, including a money-making exhibit, provided by the Treasury Department; a coal-mine breaker in action, provided by the Bureau of Mines; a forestry display, and an army and navy signal service outfit.

Two of the newest features of the exposition will be an electrical clinic, where all of the latest electro-therapeutic appliances will be on display, and "talking movies," where Edison's latest invention, motion pictures that talk, will be exhibited.

Large models of the new and not yet entirely perfected nitrogen-filled lamp will be exhibited. The new lamps at Grand Central Palace are rated at 5000 cp and are suspended from the four corners of the big central well. These lamps will be lighted for five minutes at stated intervals every day. All of the electric light companies in New York City will make special exhibits.

Additional Power for Los Angeles

Secretary Houston has just granted a permit to the Southern California Edison Company for the development of additional electric power in the Kern national forest to supply Los Angeles, Pasadena and neighboring towns. The Southern California Edison Company operates seven hydroelectric plants, one of which is in the Kern and five others in the Angeles national forest. The six plants in the national forests are capable of developing 37,000 hp, although there is not sufficient water in the streams to develop such an amount of power continuously. The company has installed, therefore, a number of auxiliary steam plants, which have a total rating of about 54,000 hp.

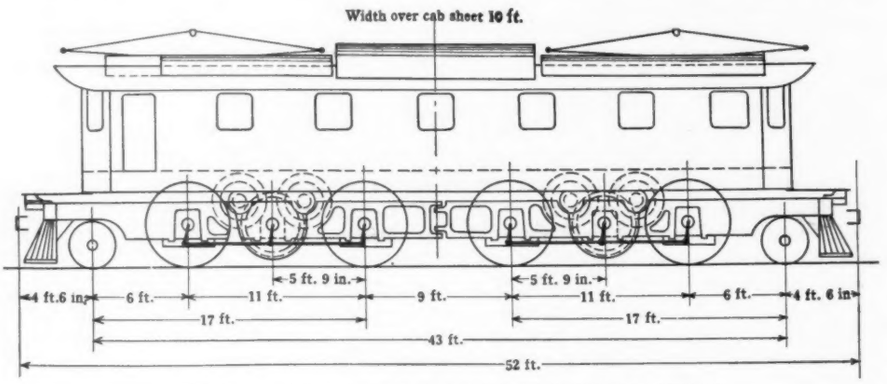
While it might be supposed that with such an amount of power at the company's command there would be little need of an additional supply, especially with other companies operating the same territory, the Edison company was convinced several years ago that it would eventually need more power in order to supply its market. The four water-power sites which seemed to be the most valuable for development are in the Kern forest, so application for a permit was made through the Forest Service in order that the company might develop these sites. It was the permit for this development which was granted by the Secretary of Agriculture.

The four projects mentioned in the permit are designated by the company as Kern River Plants Nos. 2, 3, 4 and 5. It is expected that Plant No. 3 will be the first to be put into operation, with Plants Nos. 4, 5 and 2 following in the order given as the demands of the market increase. It is stated by the company that expensive dams will not be needed but that the construction of some of the conduits will be difficult and will require a considerable amount of time. Because of this, and also because of the large investment required and the large amount of power that is involved in the development, the Department of Agriculture allows a period of almost twelve years before the plants will have to be in complete operation.

According to the estimates of the government's engineers, the four new projects of the company will be able to supply almost 33,000 hp, except for a few days in a period of five years. Through the use of its steam auxiliary plants, however, the company will be able to obtain considerably more than that amount, and it is planned to install machinery which will have a total rating of more than 80,000 hp. This will be transmitted at high tension by means of poles and steel towers over a maximum distance of about 155 miles from the plants to the city of Los Angeles.

Locomotives for the Norfolk & Western

The locomotives for the most recent electrification project, that of the Norfolk & Western Railway, will be the first to be commercially used in this country with a combined jack-shaft and gear drive. These machines will have articulated trucks and will weigh complete approximately 130 tons each. As shown in the accompanying illustration, four driving axles and two carrying axles are used, the wheelbase being divided into two separate units or trucks, connected at adjacent ends by a hinge coupling. The carrying axles are mounted radially, and each main truck has two driving axles and one radial axle. The outer ends of the trucks are fitted with standard buffers and friction draft gear with standard coupler, the drawbar pull being transmitted through the truck frames to the train. The weight does not exceed 57,000 lb. per pair of drivers and is sufficient to produce a tractive adhesion for a maximum effort of 62,500 lb. per locomotive, the weight on each radial axle being not less than 20,000 lb. at the rail. The locomotive will, with forced ventilation, have sufficient capacity to exert continuously a tractive effort of 33,600 lb.



ELECTRIC LOCOMOTIVE FOR NORFOLK & WESTERN RAILWAY

A single cab supported on the trucks at suitable bearing points contains the operating and control apparatus of the locomotive. The cab is of the box form, provided with end doors and platforms for convenient passage between two or more locomotives when coupled together, and between the locomotive and train; in addition, side doors are provided at diagonally opposite corners. There are also side and end windows for lighting the cab. The apparatus is arranged along the center of the cab, making it conveniently accessible and leaving a clear, unobstructed passageway at either side.

The control apparatus, both air and electric, is located at one end of the cab, in such a manner as to leave an unobstructed view along the track. The operator's seat is placed so that there will be a clear view of the signals.

Each locomotive is provided with two overhead pantograph trolleys having automatic self-adjusting action and arranged for a working height of 16 ft. under bridges or other permanent structures and a normal height of 24 ft. along the open line, the trolleys being controlled by air pressure.

The motors, which are of Westinghouse make, will be connected through twin gearing to a jack shaft. They are

to be of the polyphase, 25-cycle induction type with wound secondaries, which are connected in cascade for producing low speed in starting and switching. There are two running speeds, 28 and 14 m.p.h., and a switching speed of 7 m.p.h., as described on page 367 of our issue dated Aug. 23, 1913.

A multiple-unit system of control is to be provided for the independent operation of each locomotive, or for the operation of two units simultaneously from the control end of either locomotive in whatever order or arrangement the locomotive may be coupled together. The control equipment is arranged to provide for the use of single-phase current from the pantograph trolley which is connected to the primary winding of the main transformer through a suitable line switch, and from the secondary of the transformer circuits will be established through and in connection with the phase converter in such a manner as to deliver polyphase current to the main motors.

Each locomotive is to be provided with an air compressor driven from the phase converter through a multiple-disk friction clutch. This clutch is controlled by the main reservoir pressure so that the compressor is operated only as required. Straight-air and automatic air brakes will be installed together with the necessary ventilating apparatus for the motor equipment, transformers, sander and cab-heating equipment. The electrical equipment has been designed with special consideration for regeneration and electric braking at grades, both for the purpose of safety and for economy of operation, the local conditions being very favorable for this type of operation.

British Association for the Advancement of Science

By Special Correspondent

The interest of those sessions of the British Association for the Advancement of Science which were held on Monday and Tuesday, Sept. 15 and 16, centered largely about Sections A and B. On Monday a particularly striking paper on the solar origin of variations in terrestrial magnetism was read by Father Cortie.

Electromagnetic Effects of Sun

The action of the sun is, of course, well known, and there has been much discussion as to how the effect reaches the earth, thereby producing magnetic storms with great variations of earth currents and such allied phenomena. Help in the solution of the problem came from an unexpected quarter in the measurement by Hale of the actual magnetic field active in the sun through investigation of the Zeeman phenomenon. The results showed that the maximum intensity of the magnetic fields, even in regions of intense solar activity, is very moderate, indeed, far below the fields obtainable in the laboratory. Their effect seems to be quite inadequate to account for the terrestrial phenomena, and Father Cortie turned therefore to the conception of electron streams spouting from the sun and swept up by the earth in its motion. A single stream is inadequate to produce the variation in time shown by the consecutive terrestrial effects, and he therefore presented the hypothesis of an irregular sheaf of streams projected from the disturbed solar area and encountered successively by the earth, and drove home the lesson by similar appearances in the solar corona at the time of an eclipse during a time of violent sun-storms.

Utilization Versus Waste of Coal

In Section B (chemistry) most of the session was devoted to the extremely important matter of the utilization of coal, and there was general concurrence in the opinion that the present condition was one of gross misuse. Professor Armstrong, who opened the discussion, very pointedly said that while the president of the British Association was considering the possibility of entering into communication with the dead, there was obvious need of the association getting into near touch with the living. We must mend our ways if we were not to perish economically in the near future. Dr. Beilby brought to the front the low-temperature distillation of coal, which is coked at temperatures of 400 deg. to 450 deg. C., thus furnishing valuable products now consumed to small purpose, while yet leaving the most valuable part of the fuel for its ordinary use. It was the task of the gas works to organize the market for this low-temperature coke. Dr. Colman called attenton to the fact that 25 per cent of the heat units in the coal could be obtained as gas, 5 per cent as tar, and 50 per cent left as coke, while expending 20 per cent in carrying on the process, and noted the fact that the tar is worth more for its products than as fuel, while 20 per cent of the nitrogen in the coal is recovered as ammonia.

Dr. Lessing hammered in Dr. Beilby's lesson by showing that in England there is an annual loss of more than 200,000 tons of liquid fuel carried away as soot, enough to supply the whole fuel oil demand of the British Navy. The fuel oil recoverable from house coals by low-temperature coking would amount to some 3,000,000 tons a year. The whole discussion left a powerful impression of the awakening to the possibilities of the coal supply. It is worth noting in this connection that the use of water gas is declining in England owing to better methods of coal distillation.

Polarized Light and Stresses

In the engineering section Professor Cokes gave an extension of his previous fine work in the investigation of stresses by examining in polarized light the strains produced in transparent models. He had evolved thus the experimental investigation of the stresses in forms too complicated for mathematical treatment, and the results were applicable to materials in general. The method and its applications were splendidly illustrated, the stress distributions taken being those of thick cylinders and rings, both with and without discontinuities.

A New Gas

The sensation of Tuesday morning was a paper by Sir Joseph Thomson on his discovery of a new gas of which something has been heard already. By the application of his extraordinary method of analysis by the deflection of positive rays in the magnetic field he some time ago found in various cases of an apparently new gas which he provisionally called X_3. His later work indicated that this was not really new but that it was an allotropic form of hydrogen, so to speak, forming a triatomic molecule, in other words H_3 instead of X_3. It appears as a product of the bombardment of various substances in a vacuum, and its character has been pretty clearly made out.

This discovery was of itself sufficiently striking, but the speaker followed it with one even more notable. In bombarding pure potassium iodide he obtained not only much X_3 but also a considerable evolution of helium and possible traces of another of the rare gases. Now, helium is well known as one of the breakdown products of substances undergoing radioactive disintegration—in fact, it is the final product—so that the real fact brought out was the forcing by the bombardment process of the same kind of atomic disintegration that occurs in spontaneous radioactivity. This puts a new face on experimental methods that can be brought to bear on atomic constitution.

Radioactivity

Radioactivity was discussed in Section B, when Mr. Saddy brought out some very sensational suggestions,

chief of which was the theory that several elements might have precisely the same chemical character and even identical spectra while differing in atomic weight. Further, he went to the length of pointing out that by certain changes familiar in radioactivity which he described in detail it should be possible to change lead into gold with bismuth as an intermediary product. To change thallium or mercury into gold would appear to be relatively easy if certain conditions could be attained.

It may be a comfort to the holders of Rand shares that Mme. Curie, who knows a bit about radioactivity, is said to differ from Mr. Soddy's views in some vital points.

X-Rays and Crystals

On Tuesday afternoon a special session for the discussion of Professor Brogg's paper on X-rays and crystals was held. It was specially notable for some added details given by the author and for a strong indorsement of the work of Professor Arrhenius. Nobody, in fact, seemed inclined to undertake the somewhat serious task of criticism, and the general view seemed to be that an exceedingly important method of studying atomic structure had been revealed and put into practice.

Concluding Sessions

Meanwhile the combined sections on physiology, zoology and botany, with most of the chemists, had devoted a long morning session to a vigorous contest over the possible chemical origin of life. Sir Oliver Lodge strongly objected to his doctrine of continuity being put to any such application.

On Wednesday the engineering section had a long discussion of the Panama Canal, opening with a paper by Mr. Cornish on the landslides in the Culebra cut. He especially referred to the curious bulging upward of the bottom rock, sometimes to the height of 20 ft. or more. In one case a 10-ft. bulge had risen in ten minutes, and the upheavals were generally rather rapid. He considered that the filling of the canal might help or hurt according to circumstances, but did not think that slides and upheavals were likely now to occur on a scale to interfere with navigation. Confidence was expressed in the future of the canal in its influence on the world's commerce.

The final sessions in the other sections disclosed little of technical interest, and only a minority stayed through to the final closing meeting of the association in the afternoon. The meeting as a whole was a very important one with some revelations of great interest in relation to future progress and some prophecies that may or may not be fulfilled. Prophecy after the fact is the only safe kind in which to indulge. British Association meetings usually leave some landmarks on the pathway of science, and this particular one has doubtless set up a few that will be long remembered by those who pass.

Pittsburgh I. E. S. Convention

An account of the opening sessions of the convention of the Illuminating Engineering Society at Pittsburgh, Sept. 22 to 25, was given on page 619 of our issue dated Sept. 27. In many respects this was the most successful convention during the seven years of the society's existence. The attendance reached the unexpected total of nearly 500, while the papers read were of an unusually high order of merit.

Perhaps no feature of the convention stands out more prominently in the memory of those present than the banquet held at the Hotel Schenley on Wednesday evening, Sept. 24, with General George H. Harries as toastmaster. The speakers were President P. S. Millar, who responded to the toast "Old Standards of Illumination"; President-elect Charles O. Bond, "New Standards of Illumination"; Mr. Charles M. Bregg, dramatic editor of the Pittsburgh *Gazette-Times*, "The Illumination of the Stage," and Dr. John A. Brashear, "Light." Considerable humor was injected by those at different tables giving their college yells and singing impromptu songs appropriate for the occasion.

Although not on the official program, a noteworthy feature of the convention was a lunch meeting on Thursday under the auspices of the Jovian Order, with Statesman M. Frank Knapp as the presiding officer. The speakers included Mr. C. A. Littlefield, chairman of the convention committee. President P. S. Millar, Vice-president Norman Macbeth and Ex-president L. B. Marks.

At the business session on Thursday afternoon Secretary Joseph D. Israel stated that the society has a membership of 1350, the net gain during the year having been sixty-two. There are now twenty-three sustaining members.

Below are given abstracts of certain of the papers presented during the sessions on Tuesday, Wednesday and Thursday, together with the discussions thereon.

Factory Lighting

The importance of factory lighting as a load for the central station was well brought out in a paper by Messrs. M. H. Flexner and A. O. Decker, Chicago. The authors stated that ever since the realization of the good and bad effects of illumination there has always been a great field in factories for better lighting conditions. Better light is as necessary as any sanitary requirements, and with these it should rank among the first. Foreign countries have taken better illumination a little more seriously than America has. They have had committees appointed by the government, whose duties are to study the effects of good and bad light upon the general health and report upon methods of bettering conditions. Although the importance of good lighting is generally understood, managers of factories are never willing to make any decided changes from present operating conditions. No matter how forcible the arguments, the first cost of the installation of a lighting system seems to retard any change for better illumination.

The authors outlined the offer made by the Commonwealth Edison Company to introduce proper lighting service in factories in the Chicago territory. The company decided that the best way to make the offer attractive was to do away with the first cost of equipment. To insure most efficient operation the company includes in its offer the cleaning and renewing of all fixtures and lamps. The customer is asked to sign a contract for a period of twenty-four consecutive months. After the expiration of this period the wiring and fixtures become the property of the consumer. The charges for this service are made up on the following basis: rental charge, maintenance charge and electricity charge.

Rental Charge.—The rental charge is 25 cents per fixture per month, allowing the consumer to use either 100-watt, 150-watt or 250-watt units in each fixture. At the end of the two-year period this equipment becomes the property of the consumer and this charge is discontinued.

Maintenance Charge.—The consumer pays the company 25 cents per fixture per month, except during the months of June, July and August. At the end of the two-year period the consumer may elect to discontinue paying this charge and take care of this equipment himself.

Electricity Charge.—For this service the consumer pays the regular schedule rate of 10 cents net per kw-hr. for the first thirty hours' use of the maximum demand per month and 5 cents net per kw-hr. for all energy used in excess of this amount.

The fixture supplied under this contract is one that was especially designed for this class of service. It consists of a shallow reflector with a collar containing a lock socket, the conduit serving as a stem. The reflector is so designed

that the filament does not extend below the bottom of the reflector. Photometric curves show extensive characteristics. The idea throughout was to make a reflector that was efficient, plain, and easily cleaned. The company confidently expects to install 10,000 of these fixtures within the next year, and a report of the first few months gives reason for the confidence expressed.

The author stated that the campaign for good factory lighting has just begun and that the best argument in favor of better illumination is a statement showing the benefits derived from an efficient lighting system and the experiences of others. There is no longer any excuse for poor lighting; the necessity, the practicability and the economy of good illumination have been demonstrated beyond question, and if the strides in this direction which have been made in the recent past may be taken as an index of those which will be made in the future, there is no doubt that very soon the time-worn phrase "a badly lighted shop" will have disappeared from the vocabulary of those connected with the lighting industry.

Discussion

The paper was discussed by Messrs. F. W. Lloyd, Chicago; V. R. Lansingh, Cleveland; G. W. Roosa, Wilkinsburg, Pa.; H. H. Magdsick, Cleveland; S. L. E. Rose, Schenectady, N. Y.; R. B. Ely, Philadelphia; Ward Harris, Cleveland; G. H. Stickney, Harrison, N. J., and M. H. Flexner, Chicago.

Mr. Lloyd called attention to the fact that while electric motors are now freely used in industrial establishments, the lighting of factories has been practically neglected. It was this condition which caused the Commonwealth Edison Company to offer to install lighting equipment in factories at its own expense and allow the factory owners to pay for the equipment in instalments. In work of this nature the illuminating engineers can render excellent service to both the lighting company and the factory owner.

Mr. Roosa claimed that the flickering in arc lamps is not objectionable because each point receives light from many lamps and the resultant illumination is quite steady. Although the intrinsic brilliancy of the arc is very high, yet by means of inclosing diffusing glassware the exposed surface brilliancy becomes, say, 15 cp per sq. in. instead of 5000.

Mr. Magdsick cited a case of good industrial lighting where the cost of the lighting service did not exceed that of one helper for each 150 men, and said that no manager would hesitate to incur so small a relative expense for the excellent results obtained. He remarked that many of the old carbon lamps are still in use in steel mills, but are being rapidly replaced with modern high-efficiency units. He said that fully two-thirds of the amount now spent for the lighting of steel mills is wasted.

Mr. Chapin stated that the light emitted by "yellow-flame" arc lamps is much more penetrating than white light, which is largely absorbed by smoke.

Mr. Ely claimed that it is unnecessary to give away wiring and fixtures in order to insure adequate lighting in factories. The result can be accomplished by competent illumination engineering departments of the central station.

Mr. Stickney said that central stations are just beginning to appreciate the desirable features of factory lighting, which is of much importance as a source of revenue.

Show Window Lighting

In a paper by Mr. H. B. Wheeler, Chicago, were described numerous show windows with special reference to the illumination intensity required along the line of trim, the relation of reflectors, their spacings and methods of installation. The author remarked that it is always possible to interest a merchant in the true advertising value of a well-illuminated window display, because he can see increased business. It is a monetary consideration with him. He is open to conviction when the question of increasing sales is under consideration. Moreover, beautifully illuminated show windows enhance the beauty of a city and thus receive the indorsement of the citizens.

Discussion

This paper was discussed by Messrs. W. F. Little, New York; J. R. Cravath, Chicago, and H. B. Wheeler, Chicago. Attention was called to the desirability of arranging the show window architecturally, so as to conform to the requirements of good artificial illumination. Much difficulty is encountered in lighting show windows by reason of the lack of provision for the lighting requirements. The author claimed that his paper was based on tests of average show windows which can well be considered representative of modern practice. He announced his intention of preparing data by means of which architects and contractors may easily select suitable fixtures for store-window lighting.

Inclosing Glassware

Some instructive relations concerning the service characteristics of inclosing glassware were disclosed in a paper by Mr. V. R. Lansingh, Cleveland. Glassware for inclosing incandescent lamps was divided into two distinct classes, one purely transmitting and diffusing, such as ground glass, opal glass, etc., and the other prismatic glass, where the principle of specular reflection is employed. The author stated that with glassware of the first type little except good diffusion and low absorption can be expected, the redistribution of light being negligible. In the case, however, of prismatic glass, it is possible to vary the distribution in accordance with the wishes of the engineer. It is to be noted further that the absorption of light is about the same in one class as in the other.

Discussion

In the discussion, which was participated in by Messrs. S. G. Hibben, Pittsburgh; A. J. Sweet, Milwaukee; J. R. Cravath, Chicago, and the author, Mr. Hibben remarked that a distinction should be made between opal and opalescent glass and said that the conclusions derived by the author were applicable only to spherical globes.

Mr. Sweet reported the results of certain tests of lighting equipments in railway coaches, showing that so far as concerns the redirection of the light the several classes of reflectors can be arranged in the following order: Mirror, prismatic, dense opal, medium opal and light opal.

The proper classification of glassware having been discussed by Messrs. Cravath, Ives and Lansingh, it was voted to refer the subject to the committee on nomenclature and standards of consideration, together with the subject of the classification of illumination systems.

The Pentane Lamp as a Working Standard

The use of tested pentane lamps as secondary standards of candle-power when electric standards are not available was recommended in a paper by Messrs. E. C. Crittenden and A. H. Taylor, Washington, D. C. The authors gave a detailed statement of the method of testing followed at the Bureau of Standards, with general directions for the use of the lamps. The effects of variation in pentane and in atmospheric conditions were discussed, a correction for the former being proposed and new determinations of the humidity correction factor were given, a chart being provided to facilitate the reduction of observations to normal candle-power.

Discussion

Mr. C. O. Bond, Philadelphia, discussed the paper at some length, bringing out several points of importance. He called attention to the variation in candle-power values depending on the temperature, different values being obtained from solid and hollow rods on account of different conductivity. The shape of the flame changes and the candle-power therefore varies.

Mr. Bond called attention to the effect of change of pressure and the importance of keeping it constant, and also to the rapidity with which the pentane seems to vary in density.

Mr. H. P. Gage, Corning, N. Y., remarked that as the lamp is used the fuel gradually changes chemically from pure pentane toward petrol.

Dr. Crittenden, in closing the discussion, expressed the hope that it may be possible to make a pentane lamp that will compare favorably with the electric lamp as a primary standard.

Abstracts of other papers and discussion will be given in a later issue.

Illinois State Electric Association at Quincy

All the business and discussions of the annual meeting of the Illinois State Electric Association were conducted on one day, Sept. 25, but the convention visitors assembled at Quincy on the preceding day and enjoyed a steamboat excursion on the Mississippi River to Keokuk, where the hydroelectric plant of the Mississippi River Power Company was visited. The weather was ideal for such a trip, and the members of the party, about 200 in number, enjoyed themselves thoroughly. Luncheon was served on the boat. On the evening of Sept. 24 the "Leather Luggers," otherwise the supply men connected with the association, gave a smoker-cabaret entertainment in the hotel at Quincy which served as convention headquarters. The central-station men were the guests of the supply men.

President J. J. Frey, of Hillsboro, occupied the chair at the two sessions of Sept. 25. In a brief opening address he praised the work of Secretary H. E. Chubbuck, of Peoria, who has been connected with the association for fourteen years. He alluded briefly to the tendency toward centralization and concentration in the business of producing and selling electrical energy. He said that central-station men must study economies and mentioned the tendency toward the lowering of rates.

Illinois Public Utility Laws

Mr. William J. Norton, of Chicago, secretary of the rate research committee of the National Electric Light Association, analyzed the recent laws in Illinois providing for a state public utility commission and authorizing cities to acquire and operate utility plants. Mr. Norton said that thirty-six states of the Union now have state regulation of public utilities in some form. Regulation is particularly a state function. If temporarily delegated to municipalities, that fact does not invalidate the prior right of the state; there is no foundation for the "home-rule" cry. Mr. Norton remarked that the public utility commission law and the municipal-ownership law should always be considered together. Taking the two laws into consideration, it may be stated that Illinois has all the bad features of the indeterminate-franchise provision without any of the compensating advantages. There is not much in the two laws that favors privately owned utilities. The public utility commission law is complex and will be difficult to administer.

Messrs. E. D. Alexander and L. E. Marshall, of Dixon; G. R. Jones, S. B. Cushing and A. S. Scott, of Chicago; J. S. Reesman, of Waukegan; E. L. Brown, of Elmwood; O. C. Macy, of Alton; F. W. Reimers, of Rock Island, and others propounded questions to Mr. Norton in relation to the new laws. Some of the points brought out in answer to these queries may be briefly summarized.

The public utility commission law gives eminent domain to privately owned utilities under some of its provisions; it is fair in this respect. Many state laws providing for regulation of utilities include municipal utilities, although they are excepted in Illinois and Missouri and partially excepted from state regulation in Pennsylvania, Washington and California. Almost all other states having public-utility regulation give the state commission full control over municipal utilities. Mr. Norton cited Mr. Erickson, of the Wisconsin commission, who, in a public address, declared that twice as many complaints have been received by the commission in relation to municipal utilities as in the case of privately owned utilities. Mr. Norton said that more complexities would attend the issuing of stocks and bonds of utilities after Jan. 1, 1914, when the law goes into effect, and he advised his hearers to issue before that time any new securities that may be contemplated. He remarked, however, that if the municipal-ownership law is strictly enforced the rates for municipal service will be at least as high as those of privately owned utilities. In relation to competition the speaker said that a certificate of convenience and necessity must be secured from the state commission before one privately owned utility can enter the territory of an existing utility. This does not apply, however, to municipal competition. The commission has no authority to go into a city and demand that justice be done to all concerned. When a franchise expires and t city refuses to renew it the commission cannot step in and issue a franchise, but as a matter of law it is probable that the privately owned utility can keep on operating, although doubtful if it can make extensions.

Tendencies in Switchboard Design

Mr. Stephen Q. Hayes, of the engineering department of the Westinghouse Electric & Manufacturing Company, Pittsburgh, read an instructive paper entitled "Tendencies in Switchboard Design." He described panels, frames, distant control, desk boards, oil circuit-breakers and typical Illinois installations in a concise and interesting manner. Mr. Reimers, of Rock Island, inquired about the cost of hand versus electrical operation of switches in plants of small or moderate size. Mr. Hayes said that it was impossible to make more than a very general estimate owing to the variations in local conditions, but he might say in an approximate way that it would cost $25 more per switch for remote-control operation as compared with hand operation in a plant of 8000 kw.

Transformers and Lightning Arresters

Mr. John L. Buchanan, electrical engineer for the General Electric Company in the Chicago office, gave a talk on transformers and lightning arresters. He asked operators to limit the number of transformers and increase their unit capacity as much as possible. "Be a little generous," he said, "in secondary copper." The proper loading of transformers should be studied. Maximum-demand meters may be used to check up the loading. The tendency is to use transformers a little too large, and this results in inefficient operation. Taking up high-voltage transmission lines, Mr. Buchanan said that open-delta operation has certain advantages on distributing systems, but above 10,000 volts he believed it to be bad practice to connect two transformers in open delta. Surges and other troubles may destroy the transformers. Neither are "Y" connections on both sides of a bank of transformers to be recommended. There should be a closed delta somewhere in the transmission. The speaker referred favorably to the new 8000-volt transmissions in northern Illinois. This voltage fits into the 2200-4400-volt distribution; it is more logical than 6600-volt transmission. In relation to the 13,200-volt transmission which is used largely, the speaker said that it "just grew." He advocated standard voltages and also the standardization of transformers.

Speaking of the addition of single-phase load to a three-phase system (as, for instance, where an electric-furnace load is added), Mr. Buchanan said that this cannot properly be done in practice, although there were several theoretical schemes for accomplishing the result. The best plan is to use single-phase transformers. The speaker recommended auto-transformers to change three-phase to two-phase energy.

Considering protection from lightning, Mr. Buchanan made the point that the operator of a system should put the lightning arrester where the protection is needed, say at the transformer banks, and preferably on every distributing transformer. Generally speaking, the money will be well spent if an aluminum-cell lightning arrester is arranged on the station busbars. The speaker referred briefly to a new device known as the arcing ground suppressor, which has been devised to stop high-frequency disturbances on overhead lines carrying 33,000 volts or upward or underground transmissions of 13,200 volts or upward.

Handling Freight Bills

Mr. A. S. Scott, of the Public Service Company of Northern Illinois, read a paper on "The Handling of Freight Bills." He advocated the paying of freight bills by draft and described the forms and details of this method in a large system having a home office and a number of district offices.

Proper Use of Incandescent Lamps

In a talk on the proper use of incandescent lamps Mr. Fred T. Benson, of the Chicago office of the General Electric Company, made several interesting statements. The main purpose of his talk was to plead with central-station men to operate tungsten lamps at the exact rated voltage, thus securing the highest efficiency. He said that the tungsten lamps now produced are practically as rugged as the old carbon lamps. Soon they will be sent out with only a single-voltage label instead of with a range of three voltages as at present. By operating lamps at the highest efficiency the consumer will get 100 per cent candle-power and the central-station company will get 100 per cent revenue from the wattage consumed. At the present time lamps are being used in many cases that are rated from 2 volts to 5 volts above the line voltage. One objection to this plan is that the tungsten lamp does not get the reputation for brilliant illumination to which it is entitled. The General Electric Company sends out investigators to make reports on lamp-burning conditions on the central-station systems of Illinois. Sixteen of these investigations have been made up to the present time.

A tendency in present-day lamp manufacture is to reduce the size of the bulb. This results from a shorter filament made possible by the new "Concentrated" filament, which has many turns of microscopic fineness.

At this time the 0.5-watt lamp apparently is applicable only to low voltages, not more than 33 volts; therefore, its present use is seemingly confined to series street lighting. It is probable that this lamp can be developed for multiple operation for very large units, say of 1000 cp or over. Apparently the advent of this lamp will mean that central-station companies will sell electric lighting on the basis of illuminating service rather than kilowatt-hours consumed. The new 0.5-watt series street-lighting lamps (which are filled with nitrogen) may be on the market in five or six months.

Considering the complaint against packing of lamps in five-lamp cartons, Mr. Benson contended that this style of package would result in the customer buying more lamps at a time. If the customer has a reserve of lamps, he will substitute a good lamp for a burned-out one at once, and thus the central-station company will not lose the demand from that socket.

The lamp manufacturers are now training women solicitors to sell incandescent lamps and other appliances from door to door. It is probable that the manufacturers will be able to supply women solicitors to central-station companies on request at an early date. Mr. Benson also spoke of the training school at Harrison, N. J., for sales agents, and said that no fee is required there.

In the brief discussion Mr. C. W. King, of Lewistown, suggested that if the 0.5-watt lamp is to come into commercial service the label on it should be expressed in terms of candle-power rather than terms of watts. In answer to a question Mr. Benson said that the tungsten lamp operated at its highest efficiency on a circuit of the same voltage as the lamp rating will have no tendency to blacken. Good voltage regulation should be used, of course, where tungsten lamps are operated at their highest efficiency.

Street-Lighting Rates

Mr. S. B. Cushing, of the Public Service Company of Northern Illinois, read an instructive paper on "Cost of Operating and Rates to Municipalities for Series Street Lighting." He dwelt particularly on the items of cost that enter into incandescent street lighting and told how they should be ascertained. He recommended that all lighting companies abandon as far as possible the arc-lamp system of street illumination.

Concluding Business

The committee on resolutions, of which Mr. M. L. Harry, of Decatur, was chairman, presented a report, which was adopted, extending the thanks of the association to Mr. H. O. Channon, general manager of the Quincy Gas & Electric Company; Mr. W. A. Martin, general superintendent of the Quincy Railway Company; the supply men of the association for the smoker-cabaret of the night of Sept. 24; the Mississippi River Power Company, for courtesies, and the Masons of Quincy for the use of the Masonic Temple, where the sessions of the convention were held.

Officers were elected as follows: President, Mr. E. MacDonald, Lincoln; first vice-president, Mr. F. W. Reimers, Rock Island; second vice-president, Mr. E. H. Negley, Canton; third vice-president, Mr. R. H. Abbott, Petersburg; fourth vice-president, Mr. H. O. Channon, Quincy; treasurer, Mr. C. W. King, Lewistown; secretary, Mr. H. E. Chubbuck, Peoria; assistant secretary, Mr. C. A. Willoughby, Peoria; executive committee, Messrs. W. B. McKinley, Champaign; Frank J. Baker, Chicago; R. S. Wallace, Peoria; E. W. Smith, Kewanee; J. J. Frey, Hillsboro, and the president and secretary. The committee which placed in nomination the officers named above consisted of Messrs. J. G. Learned, of Chicago; H. J. Pepper, of Champaign, and B. H. Walcher, of Hillsboro.

Indiana Electric Association at Indianapolis

What proved to be the best attended convention which the Indiana Electric Light Association has ever held was that at the new Canoe Club in Indianapolis on Sept. 24 and 25. One hundred and eighty-seven were registered at the close of the convention, the nearest approach to this number being 136 at last year's convention. The new Public Service Commission of Indiana and public-utility regulation in general were the main subjects of discussion, but much attention was also given to the discussion of accounting methods.

Governor Ralston's Views

Governor Samuel L. Ralston of Indiana was present to give an address of welcome. After extending a cordial greeting, he brought the members of the association face to face with his opinions on utility regulation. Additional elements are entering the business of operating a public utility, and corporations must adjust themselves to new conditions. Under the old methods considerable waste took place, and it is the purpose of the public-service commissions to reduce expenses without depreciating the service. The Governor is a firm advocate of local self-government, and he also believes in capital earning a fair increment if it is in the service of the public. He expressed himself as favoring a slightly larger increment than absolutely justifiable rather than one which is too low, as under the latter condition the public cannot receive the best service. In

closing, he said that the Indiana commission is composed of honest, fair-minded men and that by co-operating with them the association can derive benefit.

President Robb's Address

In his annual address President J. W. Robb, of Clinton, announced that fifty companies in Indiana are members of the association, but Secretary J. V. Zartman informed the convention at a later session that about twenty additional members had been secured recently. Mr. Robb told of meeting the Indiana commissioners and spoke in high terms of them all. Among suggestions which he made for the following administration to carry out were these: Appointment of a committee to revise constitution and by-laws; increase in membership; facilities for more revenue; separation of secretary's and treasurer's duties, and weekly or bi-weekly reports of commission decisions. There are a large number of companies in Indiana, said the president, which are controlled by holding companies outside of the State. Since these parent companies are financially interested in the State, he believes they should take out membership for each plant.

In his report Mr. J. V. Zartman, secretary-treasurer of the association, drew attention to the fact that out of 210 central stations in Indiana 150 are privately owned, and of these only fifty are members.

The Indeterminate Permit

The afternoon session was opened by a comprehensive discussion of the indeterminate permit by Mr. J. L. Clark, member of the Indiana commission. The indeterminate permit, which is indorsed by economists in general, according to the speaker, is the most satisfactory solution of the utility problem. Mr. Clark went into detail on the provisions which are made in the state utility bill for granting franchises, all of which must be in the nature of an indeterminate permit. Under the permit no amortization fund is necessary to reimburse the stockholders when the plant is abandoned at the expiration of the franchise, as was formerly necessary.

Speaking of accounting, Mr. Clark said that if a consideration is given for a franchise it should be capitalized, and if annual tax is paid on this value it should be charged as an operating expense. The ideal condition for a utility to operate under is to possess an indeterminate permit for which no consideration has been paid and on which no tax is levied. The company is then in a position to offer the best services at the lowest rates and pay a fair income to stockholders.

The Indiana law (see *Electrical World*, March 15, 1913) is different from the Wisconsin statute in that a municipally controlled or privately owned utility cannot compete with an existing similar utility without the necessity of such added service being recognized by the commission. Speaking of drastic franchises, Mr. Clark closed his remarks by saying that no service can be obtained from a dead utility and only poor service can be secured from a crippled one.

Aspects of Rate Regulation

Mr. W. J. Norton, of Chicago, read his paper on "The Two Epochs of Rate Regulation," which was originally delivered at the last Michigan convention. An abstract of this paper was published in the *Electrical World* of Aug. 30 last.

In the discussion Mr. T. C. McReynolds, of Kokomo, said that all companies in the State have gradually reduced their rates. In addition, he said that the commissions have a great opportunity to show their usefulness by assuring the public of the fairness of corporations.

Mr. F. A. Bryan, of South Bend, asked if the commission would object if a distribution line were extended to some commercial establishment and energy furnished at only a small profit, if the new load increased the load-factor and efficiency of operation of the station.

In answer, Mr. A. H. Kennedy, of Rockport, said that the Massachusetts commission would not allow the smaller consumers to pay for energy supplied to larger ones. Mr. Norton added that to his knowledge only three commissions had given any decision on such special rates. One of the New York commissions (First District) declares that cost of service is not so important as value of service in determining rates. The Wisconsin commission, on the other hand, has held that a company is justified in making special rates where it does not reduce income or increase cost of production. It requires that such special rates be filed so that under similar conditions identical rates may be obtained.

Mr. T. W. McNamee, of Wabash, asked if, in regulating rates, the commissions take cognizance of the growing period of a utility when no profit is made. Mr. Norton answered that Commissioner Maltbie, of New York, had allowed a 15 per cent development charge and a capitalization of early losses to cover this period. Mr. W. M. Wherry, of New York, added that the Wisconsin, Pennsylvania and New Jersey commissions also recognize this provision.

Mr. E. J. Condon, of Angola, told of conditions where several competing companies existed in one city and were finally merged. During competition they all suffered losses as a result of low rates, and on consolidation were allowed to capitalize these early losses. He added that commissioners in Massachusetts ruled that municipal plants cannot furnish energy below cost, as the expense of operation which finally falls on the city is not prorated among those receiving the service.

Practice Before Commissions

Mr. W. M. Wherry, of New York, who is a utility legal expert and who advised the Governor of Indiana at the time the new utility law was being considered, addressed the convention. He spoke on the practice before commissions and remarked that the success of a commission lies in its ability to reconcile opinions. Common-sense ideas are what is wanted, and not so much the power to act. There is a tendency, Mr. Wherry said, for municipal plants to make too low rates. In this way it becomes necessary for the utility to receive support from the cities' funds. It is not equitable to tax those who do not use energy to make up for those who do. Watered stock should be prevented rather than punished. If a rate for service is so low that it disturbs security of outstanding stock, it should not be made. Changes in conditions have made it necessary for commissions to attack problems gradually. The proper solution of a case will benefit both sides, as the public and the corporation are not two distinct bodies.

Mr. Thomas H. Bibber, of New York, spoke on the Jovian Order, describing it as the social co-operative end of the electrical fraternity.

Electric-Vehicle Situation

Mr. George D. Smith, of Long Island City, spoke briefly on the opportunity for central stations in selling off-peak energy if they would only push the sale of electric vehicles. Hartford and Baltimore were cited as cities in which the central stations had taken advantage of such business.

Mr. E. Darrow, of Indianapolis, said that the Merchants' Heat & Light Company of that city is charging 250 electric vehicles from its lines and all of its trucking is being done by electric vehicles.

In answer to a question put by Mr. Thomas Donahue, of Lafayette, in regard to the rate at which energy must be sold in order that electric cars may compete with gasoline cars, Mr. Smith said that it depends on contour of land and radius of travel. In New York City a maximum rate of 5 cents and a minimum rate of 3 cents per kw-hr. is charged to compete with gasoline.

Methods of Accounting

Thursday morning's accounting session was opened with Mr. F. L. Dennis, of South Bend, in charge. Mr. Dennis

solicited questions from many different companies in the State relative to accounting and distributed printed pamphlets containing them. Many accountants were present and the discussion of the various questions was entered into informally. It is Mr. Dennis' purpose to thresh out the questions in an accounting committee, after which they will be referred to the state commission for final decision. Sixty-six questions were contained in the pamphlet, some of which were solved by the same answer.

Joint Ownership of Poles

An interesting discussion arose over the joint ownership of poles. Mr. Bryan informed the members that the city of South Bend requires his company to occupy poles jointly with the Bell telephone system. As the latter has poles too short for energy distribution, the central-station company has been required to replace the poles by higher ones and deed the entire pole line, exclusive of conductors, over to the telephone company. The question arose whether the state commission would allow the central-station company to earn money on the amount invested in the pole line but which is no longer represented as property.

Mr. Donahue said that it was more of a legal question whether the electric-service company could be compelled to deed over the poles without consideration. Mr. Dennis said that such an investment could be capitalized under intangible investments, according to the Wisconsin law. Mr. W. H. Palmer, of Zionsville, said that in St. Louis such matters were settled by allowing one company to own property and the second one to pay rental. Analogous conditions were described by Mr. Kennedy, of Rockport, who tore down one plant to build nearer a clean water supply, the expense being about the same as if he had installed a filtering plant at the original station.

The Chairman of the State Commission Talks

Mr. Thomas C. Duncan, chairman of the Public Service Commission of Indiana, was the next speaker. He opened his remarks by saying that no department of state government has held greater responsibilities since the civil war than the Public Service Commission, as it has the power to make or break the great utility organizations. While conforming to new conditions, mistakes are liable to be made by the commissions, and the Indiana commission will always be ready to receive advice. In his study of the utility situation the chairman was surprised to find so much money invested in electric-service properties. The enormous debts under which these companies are growing are also remarkable. Interest obligations must be met and cannot be paid if the rates are too low. While some communities are receiving energy at too low rates, others are being overcharged, and it is the purpose of the commission to equalize these conditions.

Incivility of utility companies' employees to the consumers was cited as the best ground for public clamor against corporations. Mr. Duncan stated with emphasis that the good will of the public can be secured if the employees are schooled in courtesy, and he suggested that the larger companies establish schools for this purpose. Reducing the penalty on customers who are delinquent in paying their bills was cited as another method of securing the co-operation of the public. "If there must be a penalty, let it be as light as possible." In regulating rates and service the commission intends to give justice to both sides. The speaker suggested that it would be well for utility managers to consider a public-utility corporation as a trusteeship rather than a privately owned property.

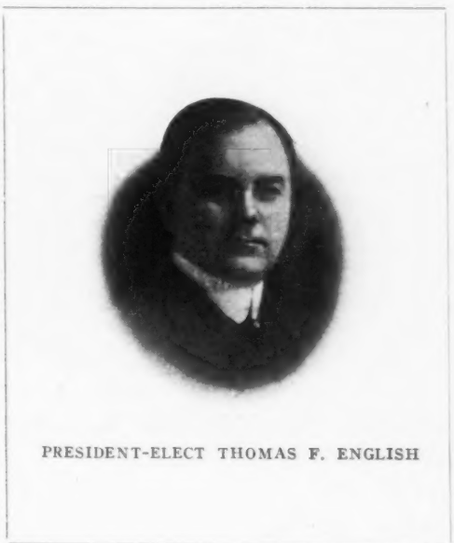
Street-Lighting Rectifiers in Accounts

Mr. Dennis took the floor at the end of the address and proceeded with the accounting session. Mr. T. F. Grover, of Terre Haute, raised the question as to what account mercury-arc rectifier tubes should be charged to where they are used exclusively for street lighting. He said that breakage of such tubes necessitates an expenditure which is greatly in excess of all other repair and maintenance charges in a station and should therefore be charged to street lighting and not be divided up among station expenses. By doing the latter, he said, the city does not bear its share of the expense and other users are burdened with a heavy charge.

This question was discussed by several, among whom were Messrs. W. H. Palmer, of Zionsvile; Eugene Holcomb, of Lansing, Mich.; L. H. Heinke, of Grand Rapids, Mich.; E. J. Condon, of Angola, and Thomas Donahue, of Lafayette. Diversity of opinions existed and the matter will be referred to an accounting committee, which will bring the subject before the state commission. Mr. Bryan added that the account entitled "miscellaneous station electrical equipment" covers a multitude of sins, and he believes that segregation of accounts should be made. Mr. Dennis said that the statistical department can segregate station accounts so that any information that may be desired can be readily obtained.

Adequate Service

The meeting of Thursday afternoon, which was the last session, was opened by an address by Mr. R. C. Huddel, of Madison, Wis., on "Service." He said that in regulating utilities the first thing which should be considered is the service rendered. Secondary in importance are the rates. Accuracy of meters, uniformity of voltage and continuity of service are items which affect service. A live management should not have to be told what adequate service is. The commission's purpose is primarily to advise the smaller companies.



PRESIDENT-ELECT THOMAS F. ENGLISH

Optional Rates

Mr. F. A. Newton, of Detroit, who was formerly employed by the Wisconsin commission, delivered a paper on "Rates." Determination of rates, he said, should be based upon the results obtained from a careful analysis of original investment and cost of operation. Rates should be dependent on two things outside of those mentioned: first, the expense incident to distribution and generation, which is independent of output; second, the expense dependent on the output. Individual consumption data also are necessary, as total earnings do not fix the determination of rates. Rates based entirely on energy consumed have been found inequitable. The type of load, time of demand and cost of supplying service must all be considered. The classification of consumers requires the most study, Mr. Newton believes. Demand devices have been of considerable value in cities where they are used in proportioning rates. Active load and unit cost are other items of importance.

Liability Insurance

The last paper of the convention was read by Mr. L. T. Block, of St. Louis. It was entitled "Utilities Indemnity Exchange." Since the time has passed when a technical defense can be made against paying a damage suit, and since a workman's compensation act is being adopted in many states, liability insurance is necessary. Inter-insurance among the utilities, which means a sharing of losses and a division of profits, was advocated by him as a means toward securing protection at actual cost.

Mr. E. J. Condon spoke highly of the Utilities Indemnity Exchange plan, and emphasized the fact that liability insurance companies are increasing rates periodically.

Concluding Business

Several committees made their reports following the discussion of Mr. Block's paper. The executive committee, whose chairman was Mr. T. F. English, of Muncie, Ind., made three recommendations which were accepted as amendments to the constitution. By these recommendations committees on utility-commission decisions, accounting and membership will be appointed by the new president. President Robb appointed a committee to revise the constitution and by-laws. The recommendations of the nominating committee, of which Mr. T. A. Wynne, of Indianapolis, was chairman, were accepted and the following men were elected: President, Mr. Thomas F. English, of Muncie; vice-president, Mr. W. D. Ray, of Hammond; secretary, Mr. Thomas Donahue, of Lafayette; treasurer, Mr. J. C. Kester, of Noblesville. Mr. J. W. Robb, past-president, was elected chairman of the executive committee.

Mr. English, who was elected president, is at present vice-president and general manager of the Muncie (Ind.) Electric Light Company. He has held that position since January, 1910, and prior to that time he was connected with the Cincinnati, Covington & Newport Light & Traction Company and the New York Edison Company. Mr. English also served as state engineer in New York.

Iron and Steel Electrical Engineers

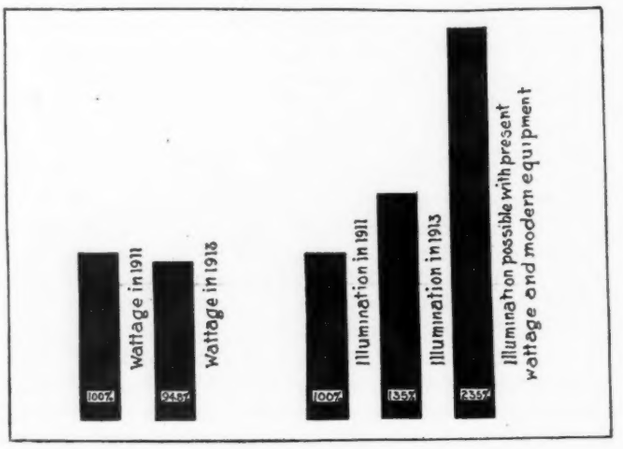
The first sessions of the convention of the Association of Iron and Steel Electrical Engineers, held in New York City, Sept. 22 to 27, were reported in last week's issue. Following are abstracts of papers presented at the later meetings and of the discussions on them.

Motor Drive for Main Rolls

In discussing the present status of motor drive for the main rolls of steel mills, Mr. Brant Wiley, Pittsburgh, Pa., stated that, from records kept during eight years of operation, the delays chargeable to motors at the Edward Thompson Works of the Carnegie Steel Company, Bessemer, Pa., had been practically negligible. The estimate of two hundred dollars per year per motor, including labor and material for repairs but excluding attendance, was given as an average figure for the 1500-hp, 220-volt direct-current motors in that plant. Tables accompanying Mr. Wiley's paper set forth many interesting data concerning American and European electrically driven steel mills. Cost data appended showed the remarkable advantages of motor drive, and in many instances central-station energy was recommended as being more economical than the operation of a private plant at the mill.

A short paper by Mr. E. Friedlaender, Braddock, Pa., in which questions on motor drive for main rolls were also answered, was next presented by the author, and discussion of the two papers was taken up jointly. One of the points brought out was the fact that roll breakage had been reduced 90 per cent in several mills following the installation of motor drive, owing to the application of graphic instruments to show conditions of undue friction and wrong sections in rolling.

Among those who took part in the discussion of these two papers were Messrs. R. Tschentscher, South Chicago, Ill.; J. M. Andrews, Schenectady, N. Y.; B. G. Beck, Gary, Ind.; C. S. Langton, W. D. Stevenson and Wilfred Sykes, Pittsburgh, Pa.; F. H. Woodhull, Coatesville, Pa.; F. B. Crosby, Schenectady, N. Y.; J. H. Wilson, Middletown, Ohio; G. M. Petty, Bethlehem, Pa.; E. Friedlaender, Braddock, Pa.; T. E. Tynes, Buffalo, N. Y., and A. G. Ahrens. One of the big items of advantage of the motor over the steam-driven mill is shown in the attendance charges. Data presented by one operator showed the total cost of attendance for steam and electric operation to be respectively $293 and $65 per year. The statement of these concise facts caused several of the members to agree that at the next convention similar figures should be prepared and presented in a paper giving comparative cost data for all operations. The use of graphic instruments in connection with electric drive for reducing friction and roll breakage was also cited as a strong point in favor of the motor-driven mill.



CONNECTED LIGHTING LOAD AND ILLUMINATION IN STEEL MILLS

Progress in Illumination

The progress report on illumination, comprehending both a discussion of developments in light sources and accessories and a review of the practice and utilization of these units for steel-mill service, was presented by Messrs. Ward Harrison and H. H. Magdsick, Cleveland, Ohio. The accompanying illustration shows the changes in wattage and illumination which the last two years have brought about, as well as the illumination which could be obtained with modern lighting methods. The report stated that the steel industry is annually losing $1,000,000 through its failure to install modern lighting installations. In the ensuing discussion the following men took part: Messrs. B. W. Gilson, Youngstown, Ohio; J. H. Wilson, Middletown, Ohio; J. C. Reed, Steelton, Pa.; I. S. Iremonger, Harrison, N. J.; C. W. Parkhurst, Johnstown, Pa.; E. Friedlaender, Braddock, Pa.; G. W. Richardson, Philadelphia; F. D. Egan, Midland, Pa.; C. E. Bedell, Wheeling, W. Va.; F. W. Detwiler, Tarentum, Pa.; J. Farrington, Steubenville, Ohio; C. T. Henderson, Milwaukee, Wis.; B. G. Beck, Gary, Ind., and O. R. Jones, Youngstown, Ohio. Where tungsten units are used on 25-cycle circuits it has been found advantageous to employ units of 100 watts or larger, in order to do away with flicker. The design of lighting systems, it was stated, should take into account the coming of the half-watt lamp, and the use of standard bases which will accommodate this new unit was strongly recommended for future lighting installations.

VARIABLE-SPEED DRIVES

Mr. K. A. Pauly, Schenectady, N. Y., presented a paper dealing with variable-speed motor drive for the main rolls of steel mills. In this he discussed briefly the advantages and disadvantages of a few types of motors which have been proposed for this service and gave a description of some of the methods suggested to provide an efficient and adjustable speed control for induction motors. The paper was discussed by Mr. W. Sykes, of Pittsburgh, Pa., and Mr. J. C. Reed, of Steelton, Pa.

ELECTRIC FURNACES

The present status of the electric furnace was touched upon in a short paper by Mr. Wilfred Sykes, Pittsburgh, Pa. For handling large quantities of material it would appear that the ideal arrangement consists in a Bessemer or open-hearth plant for main refining and an electric furnace for the elimination of the occulted gases and the reduction of phosphorus and sulphur to negligible values. The various points in favor of the arc-type and induction-type furnaces were reviewed. In Germany, it is said, the electric furnace when used with the Bessemer is now able to compete with the open-hearth furnace. Data were given showing the production of iron and steel from electric furnaces in the United States and in Germany from 1908 to 1912.

A written discussion from Mr. William B. Jörkstedt, of New York City, read by Mr. J. Farrington, commented upon the thermal efficiency of the Frick furnace, which it is said will produce high-grade steel with an energy consumption of 90 kw-hr. per metric ton. Other speakers in the discussion included Dr. Richard Amberg, Messrs. R. B. Williamson, Milwaukee, Wis.; J. H. Reniers, Pittsburgh, and E. Friedlaender, Braddock, Pa.

QUESTION BOX

The opening of the question box following this discussion precipitated a lively debate among Messrs. J. H. Wilson, Middletown, Ohio; E. Friedlaender, Braddock, Pa.; C. E. Bedell, Wheeling, W. Va.; T. T. Tynes, Buffalo; F. H. Woodhull, Coatesville, Pa.; M. Pfatischer, Bayonne, N. J.; K. H. Cederlund, Duquesne, Pa.; F. A. Wiley, Chicago; W. T. Snyder, McKeesport, Pa.; E. H. Wentz, Lorain, Ohio, and F. D. Egan, Midland, Pa.

A question on ball-bearing motors elicited from Mr. M. Pfatischer the information that the idea is very practicable except for motors with exceptionally heavy bearing pressure. Mr. Cederlund, answering a question concerning the lighting of slag pits, stated that by taking an ordinary tungsten lamp, inverting it and pouring paraffine around the metal parts a fixture is formed capable of withstanding the acid fumes and steam arising from the pits. The question of inclosing all switches carrying pressures as low as 250 volts and 110 volts brought out the fact that it is nearly as cheap to buy a switch installed in a box and thus obtain the added advantage of freedom from dirt.

STANDARDIZATION MEETINGS

At the standardization meetings which occupied much of the time on Friday the discussion seemed to indicate that the majority of smaller details in specifications would be left to the manufacturer and that the standardization rules of the A. I. E. E. would be adhered to in drafting specifications for steel-mill apparatus. The manufacturers indicated a desire to meet the demands of the steel-mill operators, whatever they might be, but suggested close adherence to the A. I. E. E. rules.

HERRINGBONE GEARS

The paper on "Herringbone Gears for Steel Mills" was presented by Mr. P. C. Day, following his arrival from Europe on the *Mauretania*. The author pointed out the advantages of herringbone gears for noiseless transmission of power at high velocities. The difference between the action of herringbone gears and spur gears he likened to that between a series of hammer blows and a series of successive, continuous pushes. In conclusion, the author advised that overhung pinions and gears be avoided as much as possible, that high ratios be used where necessary and that a speed of 1500 linear ft. per minute be the aim, although any speed up to 3000 ft. per minute is entirely practicable for open gears. Those who spoke in the discussion were Messrs. H. H. Salander, Youngstown, Ohio; W. Sykes, Pittsburgh; K. H. Cederlund, Duquesne, Pa.; E. Friedlaender, Braddock, Pa.; F. E. Egan, Midland, Pa.; B. W. Gilson, Youngstown, Ohio; B. G. Beck, Gary, Ind., and H. B. Conover, Mingo Junction, Ohio.

Among the members who have been using herringbone gears the sentiment was strongly in favor of their almost universal adoption. Mr. K. H. Cederlund cited several instances where their use had reduced commutator and motor troubles to a minimum.

Public Service Commission News

NEW YORK COMMISSIONS

The New York Public Service Commission, Second District, has authorized the issue of $400,000 capital stock and $100,000 of ten-year debentures by the Corning Light & Power Corporation. The stock is to be sold at not less than par and the debentures at not less than 90. The corporation is to acquire the property and franchises of the Corning Gas & Electric Company and to make extensions and improvements to the property. The latter company has $375,000 stock and $363,000 bonds outstanding. It has gross earnings of about $75,000 a year and net earnings of $47,000.

CALIFORNIA COMMISSION

The Oro Electric Corporation, which was refused permission by the California Railroad Commission to transact business in Stockton, Cal., and vicinity, in competition with the Western States Gas & Electric Company, has carried the case to the courts. In doing so the corporation takes the ground that when the city of Stockton granted a franchise the commission had no right to refuse to permit operation under the franchise.

The California Railroad Commission has been asked to approve the consolidation of the Coalinga Water & Electric Company, the Midland Counties Gas & Electric Company, the Paso-Robles Light & Water Company and the Russel-Robinson Water and Electric Company. The title of the consolidated company would be the Midland Counties Public Service Corporation.

WEST VIRGINIA COMMISSION

Rules have been issued by the Public Service Commission of West Virginia for the guidance of companies which desire a permit to develop hydroelectric power. The rules are designed to make companies show that they are not seeking the permit for speculative purposes or to monopolize the power of streams. The companies are required to give full information in reference to physical matters incident to construction work and also in regard to their financial resources. Copies of the application and of all other information furnished to the commission must be filed with the clerk of the county in which the development is to be made.

WISCONSIN COMMISSION

The Wisconsin Railroad Commission held a hearing recently to discuss the proposed rules and regulations affecting telephone service with a view of revision before the standards of telephone service are prescribed. The meeting was attended by representatives of all the large telephone companies as well as of many of the small independent companies. The proposed rules are essentially the same as the tentative rules proposed during the meeting of the State Telephone Association last year. Among the

subjects discussed were the speed of answering calls by operators, adequacy of switchboard capacity, reliability of service, line construction, limitation of the number of telephones on a line, testing and maintenance of lines and equipment, issue of directories and publication of all rules affecting the public, records of complaints, etc.

The Chippewa Valley Railway, Light & Power Company has been empowered to increase its minimum bill for electric lighting in the city of Spring Valley from 75 cents to $1 per month.

Current News Notes

Wireless Amateurs Listed.—The extent to which wireless telegraphy has been taken up by amateurs is disclosed in a list of radio stations in the United States issued by the Commerce Department's Bureau of Navigation. Almost 1300 amateurs had been granted licenses up to July 1.

* * *

Home for Disabled Electricians.—At the recent international convention of the Brotherhood of Electrical Workers at Boston, Mass., a resolution for devising means to establish a home for disabled members was approved, and committees from several sections of the country were named to work out recommendations to be submitted to the next general convention.

* * *

Temperatures Within Two Degrees of Absolute Zero Reached.—It was announced at the recent International Congress of Refrigeration held in Chicago that Dr. Kanerlingh Onnes had produced a temperature of 426 deg. Fahr. below zero. At that temperature it is declared metals lose their electrical resistance so that minute wires can carry any distance all of the energy generated at Niagara Falls.

* * *

Electricity Thieves in Fort Wayne.—Some trouble has been experienced recently by the Fort Wayne & Northern Indiana Traction Company, of Fort Wayne, Ind., which sells electricity for commercial purposes in that city, by the activities of electricity thieves. In one case the culprit made a connection with the service wires on the wrong side of the meter. Evidence was furnished to the prosecuting attorney of the county, who took charge of the case. On arraignment the defendant pleaded guilty and received a sentence of $10 and costs, the latter amounting to about $25.

* * *

Chicago Jovians Promoting Electrical Development.—To help in the membership campaign of the Society for Electrical Development the Chicago Jovian Club has offered a prize of $100 to the member of the club who secures the largest number of members for the society before Oct. 10. The society has already offered large prizes for the Jovian club obtaining the most members, and this additional reward is an evidence of the Chicago Jovians' cordial cooperation. The local prize was voted at a luncheon given by the Chicago Jovian Club on Sept. 16, following a talk by Mr. A. A. Gray.

* * *

Mexican Northern Power Company Stops Work.—We have been informed by the Mexican Northern Power Company that the announcement made in these columns on Aug. 23 with reference to the company's hydroelectric development on the Conchos River is erroneous. The company has decided to suspend all constructive operations until the political disturbances affecting its work have ceased, and not because of government intervention as stated. Under the prevailing conditions it is impossible to transport to the dam the necessary supplies to finish the work.

Electric Signs for Railroad Crossings.—At the meeting of the American Railway Safety Association held in Chicago on Sept. 22 the subject of grade-crossing accidents was discussed. It was proposed that electric signs be erected on highways at a little distance from railroad crossings so that the drivers of automobiles could see the signs at night and bring their vehicles to a stop before the crossing was reached. Electric signs at railroad crossings are in use to some extent in California but are not common in the East.

* * *

Cloudburst and Lightning Interrupt Service in Nevada.—Mr. F. B. Mechling, district manager of the Nevada-California Power Company, in Goldfield, Nev., reports that the greater part of the company's distributing system in Nevada was affected by an electric storm on Sept. 15. On that date electric service was interrupted for approximately two hours. In Goldfield conditions were worse, the lighting service being interrupted for twenty hours by a flood caused by a cloudburst. With the exception of having a few oil switches burned out and transformer terminals burned off, the company suffered only a slight loss.

* * *

Civic Federation to Frame Compensation Act.—The joint commission on the operation of workmen's compensation acts in the various states which was created at the National Civic Federation has decided to make a personal investigation of the operation of the Washington act, inasmuch as that state is the only one in which compulsory state workmen's compensation insurance is enforced. Ohio has an amended law which will take effect on Jan. 1, 1914, and the elective law enacted in California in 1911 will become effective on that date also. Twenty-two states have adopted workmen's compensation acts, and the investigations made by the committee are to be utilized by the workmen's compensation department of the Civic Federation in formulating a new model law for uniform state legislation.

* * *

SOCIETY MEETINGS

Electric-Vehicle Prospects in Philadelphia.—Mr. Harry Lasher, of the Philadelphia *Press*, spoke briefly of the electric-vehicle situation in Philadelphia at a recent meeting of the Chicago Section of the Electric Vehicle Association. The trend of the automobile situation in Philadelphia is toward the electric vehicle, he said, and the Philadelphia Electric Company is helping the good work. The use of electric gear shifts and other electrical improvements on gasoline cars was also mentioned. One need in Philadelphia is the erection of suburban electric garages. There is a very large downtown garage, but the facilities for the storage and care of electric vehicles in Philadelphia's extensive suburbs are inadequate. There is talk of organizing a Philadelphia section of the Electric Vehicle Association.

* * *

Meeting of the Philadelphia A. I. E. E.—The Philadelphia Section of the American Institute of Electrical Engineers will hold afternoon and evening meetings on Oct. 13 at the Drexel Institute, Thirty-second and Chestnut Streets. At the afternoon session Mr. Charles Fair will present a paper on "Electric Drive in Machine Shops" and Mr. H. P. Liversidge will speak on "Industrial Substations." During the evening session Mr. Paul M. Lincoln will present a paper on the "Relation of Plant Size to Power Cost." Visits will be made to the engineering laboratories and shops of the Drexel Institute and to the electrical engineering laboratories of the Towne Scientific School of the University of Pennsylvania. Dinner in the evening will be served at the Normandie. Mr. Joseph D. Israel, 1000 Chestnut Street, Philadelphia, is chairman of the local arrangements committee.

Hydroelectric Energy for Worcester Railway System—I

Features of Connecticut River Transmission Company's 120,000-volt lines and substations—Outdoor switching installation—Additions to Millbury plant

THE Worcester Consolidated Street Railway serves the second largest city in Massachusetts and a tributary suburban and rural district extending from Fitchburg on the north to the Rhode Island state line on the south. It operates about 90 miles of track in the city of Worcester and 170 miles outside, its schedules demanding the daily rush-hour use of about 400 cars and meeting the traffic requirements of a territory about 40 miles long by 30 miles in width.

On its lines are operated both a passenger service, varying in density from that required in the most congested city street to that suitable for cross-country or interurban patronage, and a rapidly growing electric express business of far-reaching possibilities On such a system, largely made up of what were formerly separate railways now assembled under a single management, the problems of power supply in the face of rapid population increase are of much engineering interest.

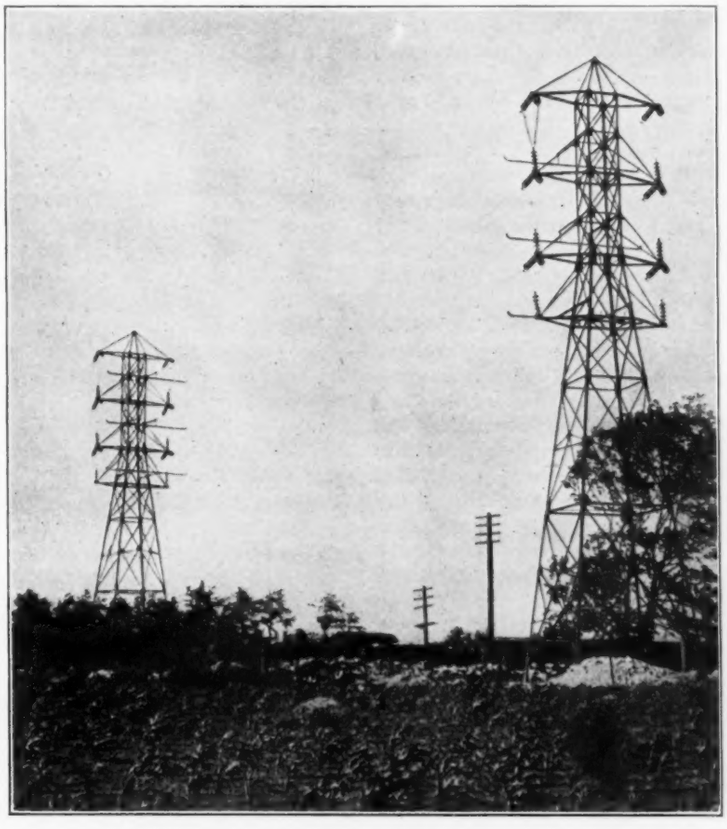


FIG. 1—66,000-VOLT TRANSMISSION LINE CROSSING AT MILLBURY JUNCTION

For many years the principal source of power on the Worcester system was the Fremont Street station at Worcester, supplemented by various steam plants of moderate capacity in the outlying portions of the area served by the company. About two years ago an important change in policy was inaugurated by the building of a 5000-kw steam-turbine station at Millbury, 6 miles south of Worcester; the construction of a 3000-kw rotary-converter substation on Madison Street, in the heart of the city of Worcester, and the building of a 13,200-volt, 25-cycle steel-tower line between these points. The Fremont Street station was then retained as an auxiliary plant and connected with the Madison Street substation by direct-current tie lines. The Millbury station was planned for the ultimate addition of several units of the capacity initially installed and a second 5000-kw turbo-generator set is now being added.

Introduction of Hydroelectric Power

Since the Millbury steam station was first placed in operation the high-tension hydroelectric transmission system of the Connecticut River Transmission Company has been extended into southern Worcester County, and a contract has been signed for the supply of energy to the Consolidated company at a number of points, the most important ot these being at Millbury, which has become the operating headquarters of the Connecticut River Transmission Company's system.

A few lines upon the general features of the Connecticut River company's service will therefore be included, in view of its importance in the wholesale electric service supply of central New England.

The present yearly output of the plants connected with the Connecticut River company's lines exceeds that of the combined central stations of Massachusetts with the exception of the Boston Edison company. The water-power generating stations of this organization are located on the Connecticut River at Vernon, Vt., and on the Deerfield River in the Shelburne Falls district. A small amount of hydroelectric power is purchased by the company from the Clinton Dam station of the Boston Metropolitan Water and Sewerage Board, and by reciprocal contracts between the transmission company and various customers the generating plants of the latter are available in case of shortage to feed energy back into the system and thus assist in maintaining high standards of service. The present rating of the hydroelectric station of the Connnecticut company and its affiliated interests on the Connecticut and Deerfield rivers is about 35,000 kw.

The transmission lines, as shown by the accompanying map of the system, form a loop from Vernon to Shelburne Falls and back through the Fitchburg, Clinton, Worcester, Millbury and Brookfield districts, with various branch lines and a proposed extension loop through Rhode Island to Providence and thence back to Millbury via northeastern Connecticut. On the north side of the system the lines between Vernon and Millbury are designed for 66,000 volts and are operated at this pressure, while on the south the lines from Shellburne Falls to Millbury and thence to

Providence are designed for operation at 120,000 volts. The frequency is 60 cycles.

The system has been developed under the general direction of the Chace-Harriman interests of Boston, and its influence in the electric-service situation in this territory is rapidly increasing. It is already the most extensive power system in New England, deriving its energy from waterwheels, and its line arrangements are being carried out with the object of providing continuous service in face of every emergency which can be foreseen. Each of the main lines carries two three-phase transmission circuits. Steel-tower construction is employed on all the high-tension trunks. On the Deerfield River development reservoir capacities aggregating 7,000,000,000 cut. ft. are planned to insure uniformity in the water supply.

Location of Substations

Energy is supplied to the Worcester Consolidated Street Railway system from the Connecticut River Transmission lines through substations at Millbury, Greendale, Fitchburg, Leominster, West Berlin, Northboro and West Boylston, Mass., the attendance at the Greendale and Fitchburg installations being provided by the transmission company in connection with the operation of adjoining substations for its own commercial customers' service. In addition to the Madison Street substation in Worcester, the railway company operates distributing substations at Oxford (Texas substation), Webster, Leicester and Sturbridge. In the fall a substation will be established in the old Charlton City steam plant of the former Worcester & Southbridge Street Railway. A list of these substations with their equipment capacities in rotary converters is given in the accompanying table.

The Consolidated company's steam generating plants will have an aggregate capacity of 18,300 kw upon the installation of the second 5000-kw turbine set at Millbury. The company also purchases about 330 kw from the Worcester Suburban Electric Companies at the Uxbridge generating station of the latter. Generators belted to waterwheels and having a combined capacity of 500 kw are installed in the Leominster power station of the railway company, so that the total amount of auxiliary steam power available is 18,800 kw. The rotary converters now connected to the

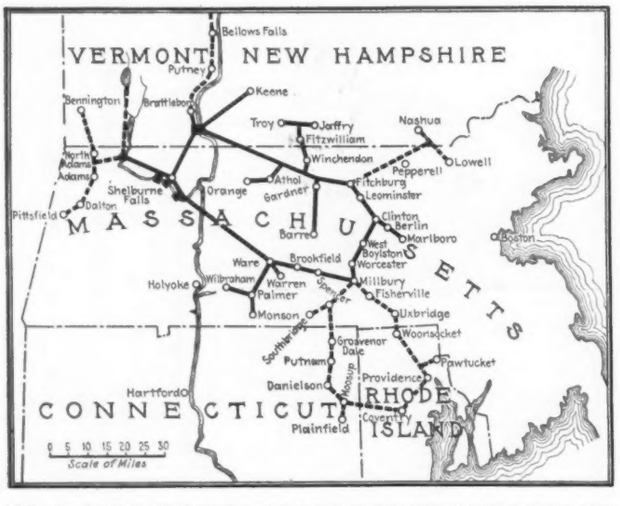
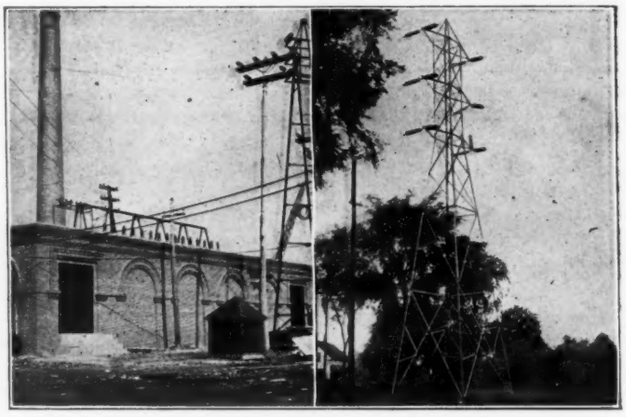


FIG. 2—LINES OF CONNECTICUT RIVER TRANSMISSION COMPANY AND ITS CONNECTING AND PROPOSED LINES

Connecticut River company's system have an aggregate capacity of 3300 kw, exclusive of the machines at the Madison Street substation. At Millbury a 3000-kva frequency-changer set has been installed to furnish 25-cycle current to the railway company from the Connecticut River system.

In general the substations on the south side of the Consolidated system are equipped with 25-cycle rotaries, while those on the north side are 60-cycle machines. At Millbury 13,200-volt lines between the Connecticut River system and the Consolidated plant provide for the supply of current at both frequencies from the former. The Madison Street substation contains two 1500-kw, 25-cycle rotaries and two 2000-kw, 60-cycle rotaries, each pair being supplied with energy through appropriate transformer banks and an independent three-phase No. 0 copper line 6 miles long between Millbury and the former point.



FIGS. 3 AND 4—WORCESTER CONSOLIDATED SWITCHING STATION AT MILLBURY, MASS., AND 120,000-VOLT LINE OF CONNECTICUT RIVER TRANSMISSION COMPANY ENTERING STATION

Steam Generating Plants

The steam generating plants of the company are as follows: Millbury, 10,000 kw; Fremont Street, Worcester, 5650 kw; Unionville, 800 kw; Charlton City, 400 kw (as planned for the coming fall); Northboro, 650 kw; West Berlin, 225 kw; Leominster, 800 kw (not including 500 kw installed waterwheel-driven generators). The Millbury station is the only one of these which measures up to the most modern standards, and the smaller plants are useful in their reserve capacity only in relation to the present plans for power supply throughout the system. The smaller stations contain generating units of moderate capacity, frequently belt-driven, and their boilers are hand-fired. While most of the engines are of the condensing type, the local load-factors are not favorable to high steam economy, and the facilities for coal supply are expensive. With the exception of the Fremont Street station, most of these smaller plants were built either to operate interurban and suburban lines with cars run on long headways or to supplement the generating facilities at Worcester. Their sites and frequently their building interiors provide space

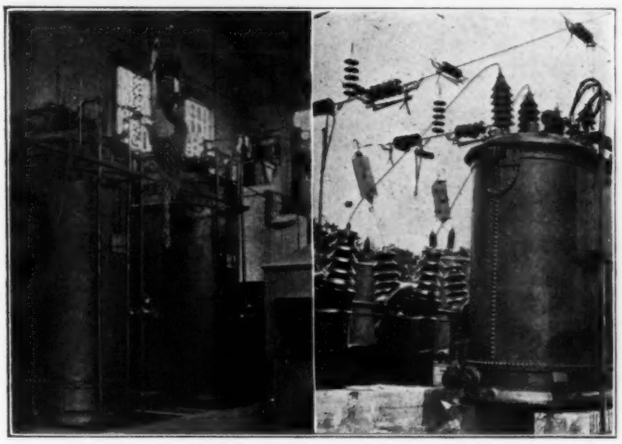
SUBSTATIONS OF WORCESTER SYSTEM, WITH THEIR RATING

Location	Rotary Converters		Total Kw
	No.	Rating, Kw	
Madison Street, Worcester	2	1,500	3,000
Madison Street, Worcester	2	2,000	4,000
Fitchburg	1	300	300
Leominster	2	300	600
West Berlin	2	300	600
West Boylston	2	300	600
Northboro	2	300	600
Millbury	2	300	600
Texas (North Oxford)	2	200	400
Webster	2	225	450
Charlton City	2	400	800
Leicester	2	300	600
Sturbridge	2	200	400
Greendale	2	300	600
Total	27	.....	13,550

for substation equipment in localities easily served from these centers, and by including one or two licensed engineers and firemen in these revised installations a flexible arrangement of personnel results.

The addition of a second turbine to the Millbury station is being made without the installation of more boilers, as sufficient steam-generating capacity is to be secured through the erection of a Sturtevant economizer of 10,000-sq. ft. heating surface in connection with the existing four 820-hp Edgeworth water-tube boilers. These are each equipped with Murphy stokers and are operated at 200 lb. steam pressure. The draft is supplied by a Kellogg circular brick stack, 225 ft. high and 12 ft. in inside diameter. An interesting feature of the plant is the handling of its circulating water for condensing service, this being effected entirely by gravity from the Blackstone Canal. Two 225-kw engine-driven, direct-current generating sets have been removed from the engine room in connection with the installation of the second turbine, which is a General Electric machine of the Curtis horizontal type, equipped with Worthington surface condensing apparatus and similar to the first machine installed two years ago.

The foundations of the unit are of concrete and are 18 ft. deep, 30 ft. 8 in. long at the bottom and 15 ft. wide. The turbine room, 96 ft. long by 52 ft. wide, now has



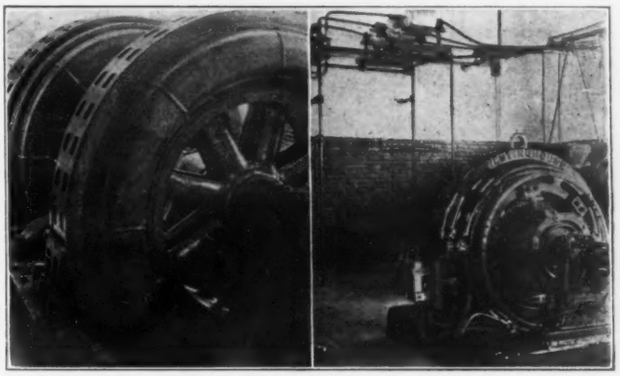
FIGS. 5 AND 6—MAIN TRANSFORMERS IN GLENDALE SUBSTATION, AND THREE-PHASE TRANSFORMER AND 66-000-VOLT OIL SWITCHES, MILLBURY OPEN-AIR STATION, CONNECTICUT RIVER TRANSMISSION COMPANY

space for three 5000-kw units and two 300-kw rotaries which are shortly to be transferred from a temporary wooden structure at the front of the company's premises to the interior of the station. The turbine takes steam from a 14-in. header in the boiler room through a 10-in. supply pipe and discharges its exhaust into the condenser directly beneath the machine. The circulating-water intake pipe is 24 in. in diameter and drops about 6 ft. between the canal and the bottom of the condenser, running through the basement on a cinder concrete foundation. The turbine is provided with a 30-in. atmospheric exhaust connection leading to a Blake automatic relief valve and thence to the roof. The circulating water from the condenser is discharged through a 24-in. pipe into a 4-ft. by 5-ft. tunnnel of concrete passing longitudinally through the basement and leading to the Blackstone River.

LAY-OUT OF HIGH-TENSION EQUIPMENT

An accompanying drawing illustrates the general scheme of connections at the Millbury switching and substation of the Connecticut River Transmission Company, the arrangement and spacing of high-tension lines, location of transformers, air and oil switches, and other details of interest. The present installation at Millbury includes the Consolidated company's power house, a switch house for the railway company's 13,200-volt service lines on the further side of the Blackstone Canal, the transmission company's substation, and in connection with this, one of the most advanced out-door types of switching and transformer installations for high-voltage service thus far entered.

The entire high-tension equipment, including transformers, oil switches and lightning arresters connected with the



FIGS. 7 AND 8—FREQUENCY CHANGER, MILLBURY STATION, CONNECTICUT RIVER COMPANY, AND A 200-KW ROTARY, NORTHBORO SUBSTATION, WORCESTER CONSOLIDATED COMPANY

66,000-volt and 120,000-volt lines of the transmission company, is located in the open at the rear of the substation building shown in an accompanying illustration. The transformers here will eventually have three independent windings, of 120,000, 66,000 and 13,200 volts respectively, and the station will serve as a tie-in and equalizing center between the 66,000-volt and 120,000-volt systems, and also as a step-down substation, taking energy from either or both systems and delivering it at 13,200 volts. The ultimate capacity will be about 20,000 kva.

There is now also being installed a complete switching equipment for the control and interchange of two 120,000-volt lines and two 66,000-volt lines, with the usual protective apparatus. Space is provided for four, and possibly six, 120,000-volt lines for future service. A special steel structure illustrated by the accompanying construction photograph has been designed by the engineers of the hydroelectric organization for the support of outdoor

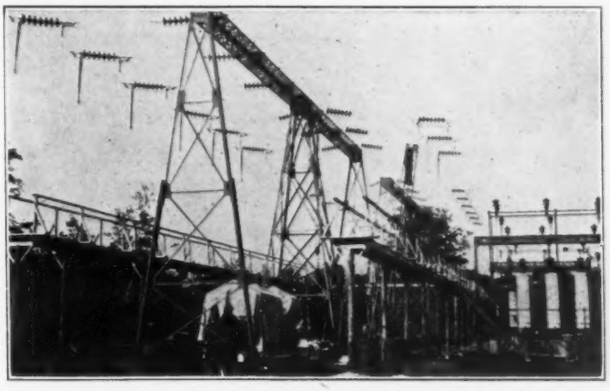


FIG. 9—STEEL BRIDGES UNDER CONSTRUCTION FOR 120,000-VOLT LINES AT MILLBURY SWITCHING STATION, CONNECTICUT RIVER TRANSMISSION COMPANY

buses. It consists of square towers, A-frames and latticed girders, assembled in combinations to suit the various requirements. In the brick building shown is now installed the 3000-kva, 60-to-25-cycle frequency-changer set mentioned before, all the control panels for the Connecticut River Company's high-tension and low-tension apparatus, the bus structures for the 13,200-volt, 60-cycle and 25-cycle

service, and low-tension lightning arresters. The stations will have a capacity of twelve 13,200-volt feeders, six of each frequency, and the present installation will consist of six 2000-kva, 66,000/13,200-volt transformers of the water-cooled type, the frequency-changer set with a 3000-kva, three-phase transformer, and a portion of the switching apparatus.

120,000-Volt Transmission Line to Millbury

The 120,000-volt lines between Shelburne Falls and Millbury are carried on a single line of American Bridge square, double-circuit steel towers, measuring 50 ft. to the lowest cross-arm and 75 ft. over all. The line is 60 miles long between the nearest generating station and Millbury, and the towers are spaced about ten to the mile. The power conductors are of No. 2/0 medium hard-drawn seven-strand copper and a ground wire of ⅜-in. double-galvanized Siemens-Martin steel strand. Suspension insulators are used, the number of disks being six in suspension and seven on strain. The line is transposed once every 20 miles, and the company's telephone circuit is carried on a separate pole line. In connection with the Millbury installation a tie-line has been constructed between the Greendale substation and the former point around Lake Quinsigamond, a distance of about 11 miles, two three-phase circuits of No. 2 three-strand copper being used. The distance from the Vernon station to Millbury is about 80 miles, and No. 2 copper is used throughout, the line being carried on steel towers and pin-type insulators.

The steel bridges supporting the bus conductors at the Millbury switching station are in general carried 30 ft. above the ground and are about 60 ft. long. Disconnecting switches are installed on each side of every oil switch. All transformers, high-tension lightning arresters and oil switches are mounted upon concrete foundations, and the lightning arresters are installed with tanks coated with white paint to keep the electrolyte cooler when in the sun's rays than is feasible with the ordinary dark-colored tank. The equipment of this outdoor switching station is of General Electric make throughout. A typical concrete pier carrying three 66,000-volt oil switches is 16.5 ft. long, 4 ft. wide and 3 ft. high above the ground. A typical transformer pier consists of two concrete beams 20 in. wide and 22 in. high above the ground in each case, carrying two 4-in. T-rails 3 ft. 6 in. apart, upon which rests a set of wheels permitting the more rapid movement of the transformer in case its location has to be changed quickly. Circulating water from the Blackstone River is supplied to the transformers through a system of 3-in. pipes by two triplex vertical pumps, each geared to a 5-hp, 110-volt, three-phase induction motor. The water is filtered and is drawn from a well at the pump house. Wooden galleries are being erected to facilitate the opening and closing of disconnecting switches from below, as illustrated in the accompanying photograph. The disconnecting switches are composed of suspension insulators with a hinged blade at one end and a Y-shaped spring clip at the other and are simple and effective in service. Several 13,200-volt, 60-cycle feeders connect the Consolidated company's switching station with the Connecticut River company's substation, besides a feeder of this voltage leading from the frequency changer. The minimum spacing between high-tension conductors in the open-air switching station is 8 ft. and in most cases 10 ft. Choke coils are placed in series with high-tension oil switch leads, and horn-gap and electrolytic arresters are liberally provided.

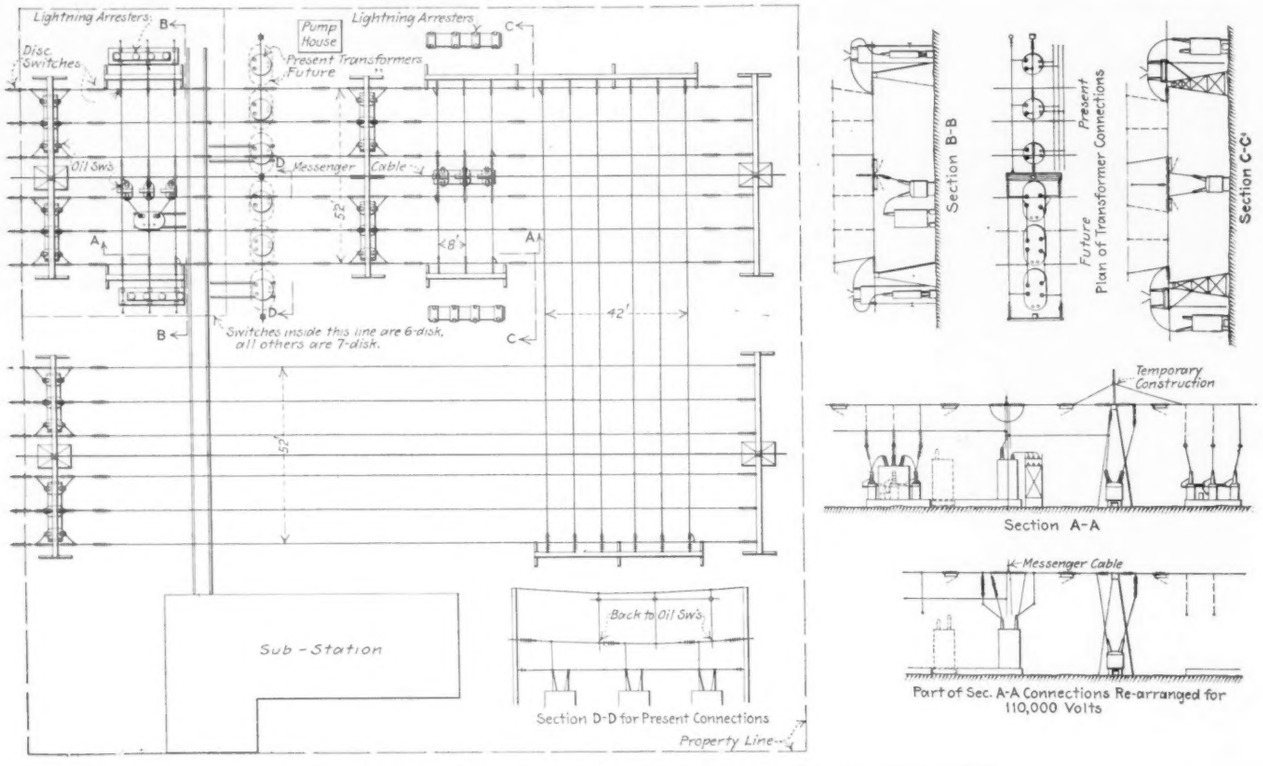


FIG. 10—ARRANGEMENT OF OUTDOOR EQUIPMENT, MILLBURY SUBSTATION

The frequency changer consists of a three-phase, 24-pole, 2300-volt, 60-cycle synchronous motor rated at 4250 hp and directly connected to a 10-pole, 3000-kva, 25-cycle, 13,200-volt generator with auto-transformer, the speed of the unit being 300 r.p.m. A 100-kw, 125-volt exciter is provided for the synchronous motor, the former being of the motor-driven type. It is housed on the ground floor of the transmission company's substation. The two machines composing the unit are mounted on a common bedplate with three bearings.

A succeeding article will describe the distribution practice, railway-substation construction features and system-operating methods of the Worcester Consolidated Street Railway Company.

The Uniflow Cylinder Adapted to Locomobiles

Utilization of the unidirectional steam-flow scheme for minimizing cylinder condensation in self-contained units using saturated or superheated steam. By Warren H. Miller

THE amazing progress made with the reciprocating engine since the competition of the turbine became so formidable as to threaten its very existence is best exemplified by the strides taken by the locomobile in the last decade. Since Josse's tests of the first locomobiles in 1901 this type has been developed and the possibilities of superheated steam have been further and further realized,

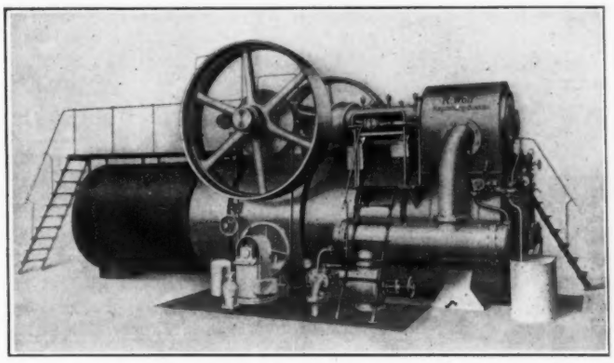


FIG. 1—UNIFLOW LOCOMOBILE

until an ultimate coal consumption of 0.83 lb. and steam consumption of 7.02 lb. per brake-hp-hr. was attained with locomobiles in daily service in the years 1909 and 1910.

Articles by the present writer relating to the early and more recent developments in the locomobile appeared in the *Electrical World* as follows: June 2, 1910, page 1442; April 6, 1911, page 842, and Aug. 16, 1913. Following is an outline of the most recent improvements in this machine in America and Germany.

Professor Strumpf's uniflow cylinder engine, developed during the last few years at Charlottenburg, Germany, promises much in the way of improved economy. The arrangement is employed to eliminate cylinder condensation by passing the steam through the cylinder in only one direction, so that during expansion the steam will find itself in contact with walls approximately of its own temperature at any given part of the stroke. This is accomplished either by using a central exhaust port and a long piston which uncovers the port at the proper instant in the stroke or else by placing an exhaust port near the end of the sweep of the piston and controlling it by a separate exhaust valve. In either case the long period of cooling of the cylinder walls during an exhaust stroke is avoided and cylinder condensation from this cause is much reduced.

It was the excessive cylinder condensation caused by the sweeping out of cold exhaust steam that resulted in the demise of the low-speed long-stroke mill engine just as soon as boiler pressures rose much above 100 lb. in general practice. For thirty years use had been made of the short-stroke, high-speed, "square-cylindered" high-pressure engine, and it proved satisfactory until the turbine was developed. Now comes the uniflow equipment, which represents an improvement on the two-cycle gas engine, getting rid of all the exhaust except that reserved for compression by means of a central port, thereby abolishing at once a nuisance that has been endured for thirty years.

While the locomobile has been developed in America along the lines of double superheat and tandem compound cylinders jacketed by the waste gases, the Wolf company in Magdeburg has applied the uniflow cylinder principle to a new line of large locomobiles of from 300 hp to 800 hp. It may seem like duplication to use both superheated steam and the uniflow principle in the same engine with the ultimate object of reducing the cylinder condensation, but this plan is quite simple and defensible.

There will always be a considerable range of temperature in the steam, whether superheated or not, between admission and exhaust. Any exhaust stroke lengthens the time during which the low-temperature exhaust steam can act on the high-temperature walls of the cylinder and steam ports, thereby cooling them below the temperature of admission. Good and efficient heat jacketing may compensate in a measure for this loss by reheating part of the steam during expansion, but in the uniflow machine any jacketing beyond that needed to take care of plain radiation is unnecessary. Each annular section of the cylinder wall area is in contact with steam of approximately its own temperature as the piston sweeps past during the stroke, and hence the temperature difference is small and the tendency to condense limited. While this is approximately true over limited ranges of steam temperature, a certain amount of exhaust steam must be reserved for compression, and this steam will exercise a certain cooling effect on the walls even though it is receiving heat from the work of compression. It therefore follows that for high-temperature admission it is best to divide the expansion between high-pressure and low-pressure cylinders, as is done by the Wolf company.

Another feature of the uniflow machine used for either saturated or superheated steam is the avoidance of preliminary condensation in the port between the valve and

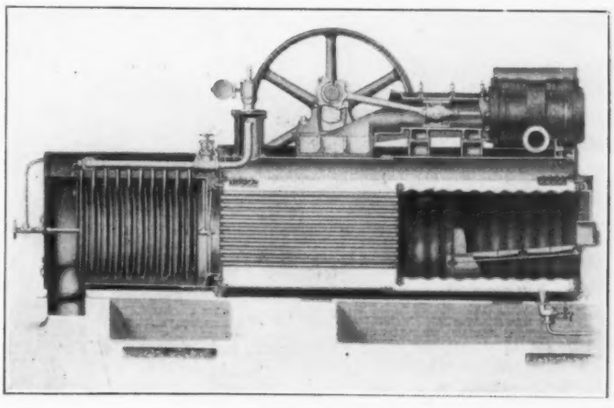


FIG. 2—LONGITUDINAL SECTION OF UNIFLOW LOCOMOBILE

the cylinder. Here, in the saturated steam engine of the single valve type, is an unavoidable passage, often long and constricted, which must be used alternately by exhaust and live steam, the former chilling the metal walls, the latter reheating them. Aside from the volume of these ports, which forms no small percentage of the total clearance, the total condensation from the contact of all the steam

with the narrow walls of the port is considerable, and this is eliminated by the uniflow arrangement with the short direct ports using only one temperature of steam.

The mechanical construction of the Wolf uniflow locomobile is shown herewith. A light piston valve admits steam superheated to about 650 deg. Fahr. through ports in the sides of the cylinder walls. On the opposite side the exhaust port is controlled by a similar and larger piston valve which admits it to alternate ends of the low-pressure cylinder, whence it rejects to the condenser by means of central ports arranged in a ring around the cylinder walls. These are uncovered by the piston near the end of the stroke, the cylinder and piston being made long enough to permit nearly all the stroke to be made without uncovering the central ports. Wire-drawing is avoided by cutting the ports diagonally with rounded corners. The long piston must, of course, appear also in the high-pressure cylinder, which accounts for the position of the two high-pressure exhaust ports as shown in Fig. 3

High-pressure and low-pressure indicator cards are reproduced in Fig. 4. Note that, as in the simple uniflow engine, admission is instantaneous, expansion beginning at once, the governor controlling the amount of steam admitted instead of the time of admission. A certain amount of reheating is noticeable in the expansion line, as is also a sudden drop as the exhaust port is uncovered. Compression begins to show at about two-thirds of the exhaust stroke.

The superheater employed is of a new design with sets of double-spiral coils connecting two manifold headers. Steam of about 216 lb. pressure is taken from a small steam dome near the superheater end of the boiler, enters one header and crosses to the other through the spirals of small pipe, arranged in "multiple," so to speak. A more efficient heat interchange between the hot flue gases and the non-absorptive superheated steam is claimed for this arrangement than could be had with the older continuous spiral type. The friction loss due to passing through some 300 linear feet of spiral superheater pipe is avoided, but at overloads this multiple type of superheater seems liable to pass saturated steam across the first few spirals without there being sufficient time for complete superheating to take place. No provision seems to have been made for cleaning out the entrained cylinder oil.

The engine frame contains several features developed independently by the American locomobile builders, the Buckeye Engine Company, Salem, Ohio. All engine

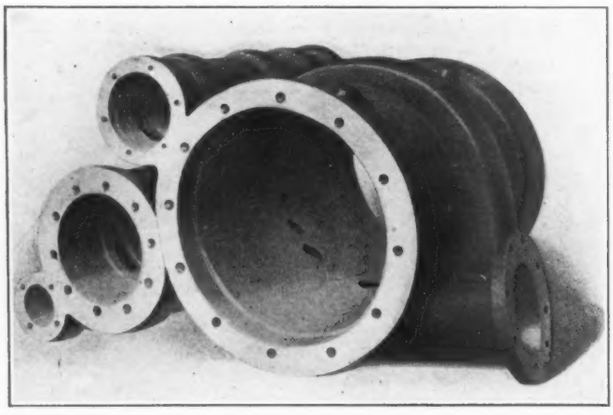


FIG. 3—HIGH-PRESSURE AND LOW-PRESSURE CYLINDER CASTING

stresses have been removed from the boiler shell. In the earlier German locomobile the crank shaft and its bearings were mounted on a saddle riveted to the boiler shell, with the cylinders on a separate saddle, the boiler shell forming the engine bed. The American builders did not take kindly to this construction, for it introduced at least three distinct disadvantages: (1) Engine stresses had to pass through the boiler shell, crossing at least two rivet joints; (2) to allow for expansion changes the engine had to be aligned and valves set under full steam pressure; (3) a copper gasket about 0.25 in. thick had to be put under the flange of all combination steam dome and cylinder castings, where the cylinders were jacketed by live boiler steam, and

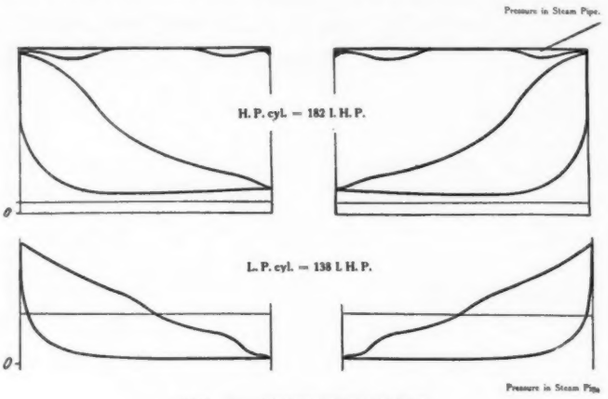


FIG. 4—INDICATOR CARDS

this gasket could then be calked tight whenever leaks developed under working stresses.

The American builders have adopted a horizontal box A-frame, connecting the crank-shaft bearings and cylinders. The latter merely rest on the rear saddle, and all stresses pass through the A-frame, which is also the cross-head guide on the usual bored American construction. The above-described feature has either been adopted from American practice or else developed independently in Germany in the latest Wolf locomobile, as will be noted from an inspection of the accompanying illustrations.

It is interesting to observe the sweeping simplifications made by the German engineers in this locomobile over their earlier types as justified by the presumably greater efficiency of the uniflow cylinder when using superheated steam. They have discarded the flue-gas jacketing of their tandem-compound unit, discarded the second superheater before the low-pressure cylinder, returned to the cross-compound type of unit with direct passage of the steam through both cylinders, and in every way simplified the steam cycle. The results thus far have been below the best that can be done with the tandem compound arrangement with two superheaters, such as American engineers adopted as the best type of locomobile.

As tested by Professor Durfner, of the University of Prague, the steam consumption of the uniflow cylinder locomobile is 8.05 lb. per brake-hp-hr. at 644 deg. Fahr. steam temperature. This has been nearly equaled by the small 40-hp "Russian" type with double superheat and low-pressure cylinder jacketed in the steam dome and the high-pressure cylinder jacketed in the smoke box, and exceeded by the larger "THC" type, double-superheat tandem compound, both cylinders jacketed in the chimney uptake (the type adopted by the American locomobile builders). The former showed 4.67 kg. steam and 0.56 kg. coal per brake-hp-hr. as tested by Professor Josse in 1904, the load on the locomobile being 55.1 hp, and the latter as tested by the Magdeburg Boiler Association in 1910 consumed 0.38 kg. coal and 3.21 kg. steam per brake-hp-hr. on the 138-hp load. This latter test was with a very high superheat of 806 deg. Fahr. and constitutes the world's record in steam economy. With the usual superheat temperature of around 750 deg. Fahr. about 9 lb. is the common value of steam consumption. This record has been duplicated in our own country by the first American locomobile ever built. The output ratings of the new Wolf uniflow locomobiles run from 250 hp to 600 hp in six units, and the floor areas necessary are from 20 ft. 5 in. by 8 ft. 9 in. for the 250-hp unit up to 30 ft. 3 in. by 12 ft. 9 in. for the 600-hp unit.

The Arc as a Standard of Light

At the recent Birmingham convention of the British Association for the Advancement of Science Mr. J. F. Forrest presented a paper relating to certain researches on the carbon electric arc as a standard of light. The experiments were based on the fact noticed by Violle and Blondel that the intrinsic brilliancy is independent of the current and the arc length although affected by impurities in the carbon. The lamp is so arranged that an image of the bed of the positive carbon is thrown upon the screen in front of the operator.

Use is made of a three-carbon combination with the electrodes so positioned as to eliminate the tendency of the arcs to climb up the negative electrodes, of which there are two.

The appearance of the crater is most interesting. It is mottled, there being a large number of irregular areas which are brighter than the background. A bright patch appears to spring from a dark patch, to spread out, star-fashion, and finally to merge into the background. The edges of a minute crack are always the source of a bright area, which sometimes moves quite slowly over the face of the crater. Everywhere over the crater, but particularly near the edges in the centers of bright stars there can be seen tiny black dots, which appear and disappear with great rapidity, giving the patch a suggestion of winking. These finally fly away. They may be impurities or, it is just possible, bubbles of liquid carbon; they are only of the order of 3/40 mm in diameter.

When the arcs are hissing the crater is no longer quiescent, but suffers violent changes of temperature and of configuration which it is impossible to describe. While hissing is actually heard a bright revolving line or comma can readily be seen by using a stroboscopic method of observation, but it almost certainly disappears with the silencing of the arc. A telephone, connected across the terminals of a low-resistance resistor, carrying all the current, affords a ready means of listening to the note emitted, without the distraction of outside noises. Starting with a loud, high-pitched note, the volume of sound and the pitch of the note become less and less until the limit of audibility is reached. At the same time the speed of rotation of the arc becomes lower and lower until it is visible to the naked eye. The cessation of sound and of rotation of the crater are apparently simultaneous. The area of the crater is approximately proportional to the current. The current density is 1.5 amp per sq. mm. This uniformity is what one would expect.

Photometric observations showed results close enough together, even including the differences in the experimenter on five different evenings and the various experimental errors which only great elaboration would eliminate, to encourage one to investigate further with those grades of carbons which are found most suitable.

Erection of Municipal Plant at Budapest

Among the social reforms undertaken by the recently elected Mayor of Budapest was the construction of a municipal power station which is to be in operation by next December. The prime-mover equipment comprises two 5000-kw Melms-Pfenninger turbines driving Blathy 10,000-volt, 50-cycle alternators. Steam will be furnished by one pair of Garbe boilers and one pair of Babcock & Wilcox units. Motor drive is to be employed for the condenser pumps and other auxiliaries. Complete protective equipment is installed on the high-tension circuits, and both hand-operated and automatic oil switches will be used.

In the congested districts of the city the substations will be installed in public and private buildings, while for the outlying regions small transformer houses are provided. Automatic oil switches are also so arranged that in case of accident to one of a pair of duplicate lines feeding an important distribution center the load will be automatically transferred to the second unimpaired cable. Four of these automatic switching centers are provided, two of them being underground installations in prominent public squares. Mr. Leopold Stark is the director in charge of construction of the new plant at Budapest.

The Photo-Electric Cell in Photometry

At the Pittsburgh convention of the Illuminating Engineering Society a paper by Prof. F. K. Richtmyer, of Cornell University, relating to the photo-electric cell in photometry was read and discussed. The following paragraphs present an abstract of it:

Since the discovery of the so-called photo-electric phenomenon in 1888 the process of manufacture of the cells has been so perfected that cells of sodium, potassium or rubidium, sensitive to light from the visible spectrum, are readily obtainable on the market. Since the intensity of the current furnished by these cells is strictly proportional to the intensity of illumination on the sensitive metal surface, the cells may be used for intensity measurements over a very great range.

In using the cell the negative pole of a battery the positive of which is grounded is connected to the alkali metal contained in the cell. A wire sealed through the glass of the cell is connected through an electrometer or galvanometer to the earth. When a beam of light is allowed to fall on the metal surface a current of electricity is produced in the circuit.

The strength of the current will depend on several things: It increases as the electromotive force of the battery is increased up to a certain point—at least, this is true for most cells obtainable on the market. It depends very greatly on the color (wave-length) of the incident light. But if these two are maintained constant the strength of the current is absolutely proportional to the intensity of illumination on the metal surface over an enormous range of intensities.

The currents furnished are in most cases comparatively small. Only the higher illuminations (say 20 or 30 ft.-candles for white light) produce currents large enough to be measured by a sensitive galvanometer. These currents are of the order of magnitude of 10^{-9} amperes. For the more common illuminations (say from 0.0005 ft.-candle up) a sensitive electrometer is necessary. Although the latter instrument is somewnat more troublesome to handle than a galvanometer, the possibilities of this method of measurement more than justify its use.

One may use an electrometer in either of two ways. If the illuminations are very small, the electrometer should be connected directly in circuit, the electrometer replacing the galvanometer of the previous connection. A key makes it possible to discharge or insulate the pair of quadrants to which it is connected. A condenser may be used in parallel with the electrometer to vary its current sensibility as required. One of the several types of air condensers is most successfully used.

With this arrangement the procedure is essentially as follows: The illumination to be measured is allowed to fall on the cell and the key is kept closed until stationary conditions have been reached. The key is then opened and the rate of drift of the electrometer is measured by a stop watch or chronograph. If C is the capacity of the electrometer system, K its constant (that is, the number of volts necessary to deflect it one scale division) and R the measured rate of drift in divisions per second, then the current I is given by $I = CKR$. The capacity used with the electrometer should be such that the rate of drift does not exceed 2 mm or 3 mm per second. However, with a good telescope and scale and proper insulation and screening for the electrometer rates of drift as low as a few

hundredths of a millimeter per second can be accurately measured.

This "rate of drift" method has its objections, partly owing to the fact that a comparatively long time is required for each observation. The writer used, as a substitute for it in some cases, the "ballistic" method. This requires in front of the cell a shutter which can be opened, mechanically or otherwise, for a definite time interval. In this method, having previously opened the key, the shutter in front of the cell is opened, allowing the illumination to fall on the cell for the desired time interval, which must be accurately measured. During this interval the electrometer has been given a certain charge, in consequence of which a permanent deflection is observed after the shutter is closed. If S is this deflection, T the time of exposure, and C and K have the same values as before, the current is given by $I = CKS/T$.

The ballistic method is useful for a great variety of laboratory measurements. Experiment seems to show that at least for moderate illuminations the quantity of electricity discharged by such a cell, subjected to a constant illumination, is accurately proportional to the time of exposure, even when the duration of the illumination is only a small fraction of a second. This makes it possible to make "snapshot" measurements of the candle-power of a fluctuating light source. The magnitude of the quantities concerned was indicated by an experiment in which a deflection of several centimeters was obtained by an exposure to a Nernst glower of 0.001 second. The glower was two or three feet from the cell. It is unnecessary to emphasize further the possibilities in this direction, for there are numerous experiments where instantaneous candle-powers are desirable under conditions where measurement by eye is almost impossible. Also, one may easily reverse the process and measure a time interval, as, for example, the speed of a photographic shutter.

When used with the ballistic method the photo-electric cell acts as a time integrator of light intensity, in much the same way as the electrolytic cell acts as a time integrator for the electric current. In other words, suppose it is desired to find the average intensity of a fluctuating light source over a certain time interval, long or short. One would simply have to expose the cell to the light source for the desired interval and read the resulting deflection. This divided by the time gives the average rate of deflection. By comparing this rate with that produced by a known light source the average candle-power of the first source is at once obtained.

A second method of using the electrometer in connection with the photo-electric cell is to connect the instrument to the terminals of a high resistance, through which the current flows on its way to earth. The principle of this method is, of course, identical with the method of measuring current by a voltmeter and resistance. Using this device Professors Nichols and Merritt have with great rapidity measured the densities of a series of photographic negatives. While this method has the advantage of giving the current directly by the steady deflection of the electrometer, its use is limited to cases where fairly high intensities are available.

The manner in which the photo-electric current depends on the wave-length or wave-length composition of the incident light is a crucial question when considering the application of the photo-electric cell to photometry. Numerous investigators seem to agree that as ordinarily used the cell obtainable on the market has a wave-length sensibility curve which, while agreeing fairly well in shape with the luminosity curve of the human eye, is nevertheless quite different in position, having its maximum much farther toward the violet end of the spectrum. The sensibility curve as determined some time ago by the writer for one of the cells then obtainable had its maximum at about 0.46 μ, although its exact position is in some doubt on account of the difficulty of obtaining a satisfactory curve for the energy distribution of acetylene, the source used, in the blue and violet. Later experiments by other investigators seem to show that the maximum is even farther toward shorter wave-lengths than here indicated.

The high sensibility to blue and violet constitutes the chief objection to the general use of the photo-electric cell for all photometric measurements. One can readily see that a slight preponderance of blue in the light as measured by eye would make a vast difference in the measurement by the photo-electric cell, unless the latter measurement were made by use of a very carefully selected set of absorbing screens, so chosen as to give the cell a sensibility curve approximating that of the human eye. On account of the high absorbing power which such a set of screens must necessarily have, the sensibility of the device would be greatly reduced.

For this reason it seems probable that the most useful applications of the photo-electric cell at the present time must be limited either to cases involving monochromatic or isochromatic light sources, or else to investigations where the actual intensity, photometrically measured, is of only secondary importance. If, for example, one were making a series of "stroboscopic" snap-shots of an alternating-current arc over one cycle, he would not expect the resulting curve to agree, either in magnitude or position of its maximum, with the curve obtained by ordinary means. It is possible, however, to isolate any wave-length from such an arc by means of a spectrometer, and by means of the photo-electric cell follow it during one cycle under conditions of intensity and color which would render eye measurement impossible. Furthermore, it is to be remembered that in the blue and violet region, where eye measurement becomes very difficult, the cell becomes most sensitive.

In addition to the difficulties previously mentioned, namely, the great care which must be exercised in studying differently colored illuminations and also the fact that the electrometer is somewhat more troublesome to handle than a galvanometer, there exists one great source of trouble, due apparently to the fact that a photo-electric cell, even in the dark, will allow a small current to flow if an electromotive force be impressed on its terminals. This seems to be caused by the walls of the cell possessing a resistance which is, of course, not infinite. This leakage current is fortunately too small to be of serious disturbance when one is measuring intensities of several foot-candles. But when working with lower illuminations of a few hundredths of a foot-candle the leakage current becomes a serious source of error. In fact, it may become much greater than the photo-electric current itself. In any event, either it must be determined and a corresponding correction made, or it must be eliminated by charging the cell to such a potential that the difference of potential between the alkali surface and the receiving wire is zero, in which case there is no leakage current. Later cells of improved construction have reduced this difficulty very greatly.

Although the proportionality between photo-electric current and intensity of illumination seems to hold over a very great range of intensities, it is probably not safe to expose any cell, for any length of time at least, to the very high illuminations (several hundred foot-candles). A cell used by the writer gave consistent and reproducible results for months when used only on moderate illuminations, until in one experiment it was exposed at intervals, totaling perhaps thirty minutes, to a 2000-cp arc two or three feet away. For weeks afterward this cell gave very erratic readings when used again on lower illuminations, the currents being not only not reproducible, but even varying with a constant illumination, as if to indicate that some sort of instability had been produced by the very high intensity.

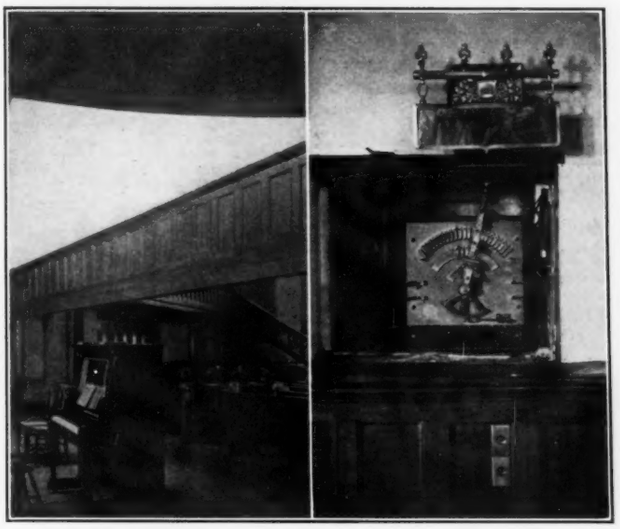
The writer stated that, in spite of some serious difficulties, the photo-electric cell is being used more and more as a photometric device for special purposes.

Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities

Novel Motor Application in a Church

From the standpoint of electric-motor application, the First Baptist Church of Worcester, Mass., is one of the most completely equipped edifices devoted to religious purposes in the East. In addition to the usual motor-driven vacuum-cleaning, organ-blowing, ventilating and exhaust fan equipments, the auditorium is provided with a motor-



FIGS. 1 AND 2—MOTOR-DRIVEN CURTAIN AND MOTOR-CONTROL RHEOSTAT, FIRST BAPTIST CHURCH, WORCESTER, MASS.

operated curtain illustrated in the accompanying photograph, which separates the main body of the church from the Sunday-school room. The curtain is of wooden construction, 8 in. thick, and is 36 ft. long, its height being about 30 ft. It weighs about 6000 lb., but through the use of counterweights it is easily run up and down by a 4-hp, 550-volt direct-current motor placed among the rafters of the church. The curtain can be raised or lowered in thirty-eight seconds without the slightest noise, the motor being controlled at a starting box at one side, as shown in Fig. 2. It is customary to raise the curtain during the singing of the final hymn, if the Sunday-school room has been isolated during the remainder of the service, and the majority of the congregation, whose backs are turned to the curtain, do not become aware of the change unless the day is dark enough for the additional supply of natural light to attract attention. Service is supplied by the Worcester Electric Light Company.

Development in Baltimore

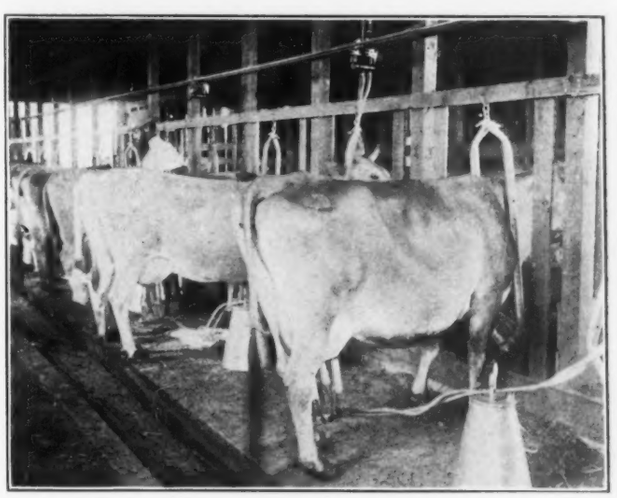
A booklet showing the development of the Consolidated Gas, Electric Light & Power Company of Baltimore refers to the existing field for the increased use of gas and electricity, particularly for motors, in Baltimore. The company has made a canvass to reveal the use of steam in power plants and factories in Baltimore and vicinity. The canvass showed that there were 433 steam plants, with an installation of 76,000 hp, where electricity could be used economically as a substitute. As compared with this, the company has 1617 motor installations on its circuits, while the motors in use have an aggregate rating of 50,800 hp. If the business in sight could be obtained at the average rate of $25.50 per hp-yr., it would add over $2,000,000 a year to the company's earnings.

Before a commercial department was established by the company the increase in electric output was much smaller than it is now. The increase in kilowatt-hours sold in 1904 compared with 1900 was 15.1 per cent. In the nine years following the establishment of a commercial department, from 1904 to 1913, the increase was 661.6 per cent. The number of electric meters in 1913 was 31,292, as compared with 3613 in 1903. The number of square miles of territory served was 270 in 1913, as compared with 30 in 1903. The average selling price in 1913 was 2.5 cents per kilowatt-hour, as compared with 6 cents in 1903.

Dairyman's Saving with Electric Milkers

One dollar per month for each cow milked is the saving which the dairyman can accomplish by the use of an electric milking machine, according to Mr. James E. Davidson, vice-president and general manager of the Pacific Power & Light Company, Portland, Ore., who presented a paper on electrified farming before the recent Seattle convention of the Northwest Electric Light & Power Association.

Roughly, one man with a four-unit milking machine can milk four times as many cows as he can by hand in the same length of time. Incidentally, the central station obtains a load that is guaranteed for every day in the year,



MILKING COWS BY ELECTRICITY NEAR PORTLAND, ORE.

with an early-morning load that is of special benefit. Every cow milked by the machine earns for the company $1.75 per year, figuring that one four-unit machine will handle a herd of twenty-eight cows.

"Eight times out of ten," said Mr. Davidson, "the salesman who is trying to sell an electric milking machine will accomplish his result if he directs attention to the facts

that with electric milking 75 per cent of the cost of milking is given back to the dairyman in net profits; that the output of milk is cleaner and better because of the decreased number of bacteria, and that the use of the machine dissipates the nightmare of always trying to find a reliable, cleanly, gentle and efficient man who will stay right on the job twice a day, 365 days in the year, who has a disposition so patient that he will gently milk a cow while she slaps her tail around his neck and places her foot in the bucket, or who will coolly sit down beside a hot cow and milk her in fly-time with the thermometer 100 deg. in the shade!

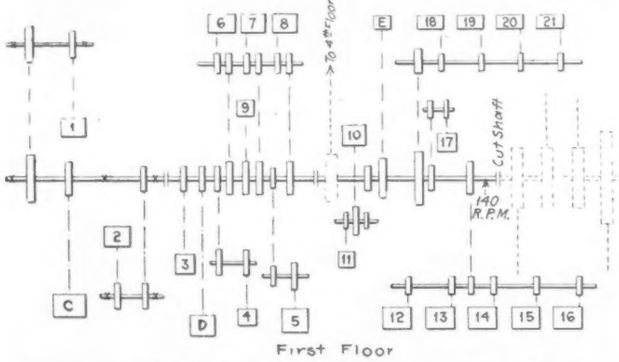
"The point is, don't talk technicalities; talk sense with cents."

State Fair Electrical Exhibits for Farmers

Year by year, state fairs are becoming more and more important to electrical manufacturers as mediums for introducing electrical appliances among farmers. The increase over last year in the number of companies which exhibited small gasoline-engine-driven electric-generating plants during the recent Wisconsin State Fair at Milwaukee shows, for example, that these companies have realized the opportunity afforded for exhibiting their products to a class of citizens heretofore reached in only a casual way. And, on the other hand, the eagerness with which the rural visitors viewed the newly developed electric-lighting plants and motor-driven farm appliances should prove the receptive attitude of the farmer as a user of electricity. Of the four thoroughfares which extended the length of the fair grounds at Milwaukee, two were devoted almost entirely to the exhibit of machinery. Among these displays were many internal-combustion engine-driven generating plants and various motor-operated farm appliances, such as cream separators, automatic milkers, refrigerating plants, milk-bottle fillers, water-pumping systems, washers and wringers, tool grinders, etc.

Electrifying a Water-Meter Factory

In the following paragraphs are given the essentials of a motor-service survey lately made by a central-station company in a water-meter factory operated by steam and containing nearly 170 productive machines. The equipment



1-5 ft Radial Drill, 2 40 in Lathe, 3 Drill, 4 Boring Mill, 5 Radial Planer, 6 30 in.×30 in. Planer, 7 20 in.×16 in. Planer, 8-30 in Lathe, 9 Drill, 10-Grindstone, 11-Shaper, 12-16-16 in. Lathes, 17-Shaper, 18-21-20 in. Lathes. C-3 HP Motor-1200 R.P.M., D-5 HP Motor-1200 R.P.M., E 5 HP Motor 1200 R P M 25 Lamps, 10 Lamps in Office

FIG. 1—TYPICAL LAYOUT SHEET FOR FIRST FLOOR

consisted mainly of machine tools common to iron-working establishments, including many lathes, grinders, blowers, planers, drills, milling machines and other appliances of moderate size. On account of the first cost of individual motor drive it was considered desirable to figure the installation on a group-drive basis, leaving to the owners such gradual change to direct-connected motors as might be found desirable in the future. The data obtained are representative of conditions in small machine shops where group driving is the line of attack on behalf of the installation of central-station service to take the place of mechanical drive by steam or other power.

The plant was driven by shafting and belts from a simple non-condensing engine of about 100-hp rating, steam at

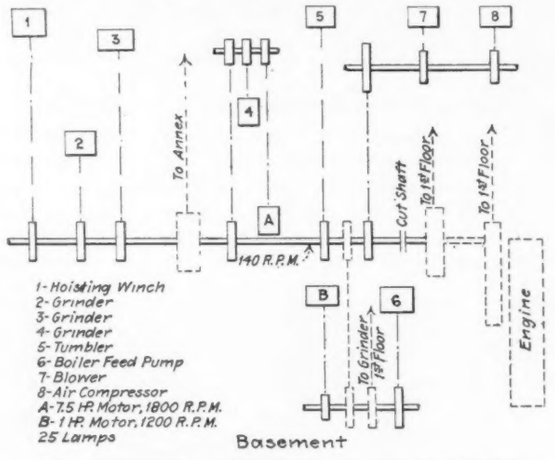


FIG. 2—TYPICAL LAYOUT SHEET FOR BASEMENT

90-lb. pressure being supplied from a boiler with a 66-in. shell. The size of the building was too great for the needs of the factory owners, so the motor service included an allowance for electricity resold to tenants, which resulted in an estimated saving of 13 per cent over present costs, by the installation of central-station service. In assembling the data secured, the central station's engineers plotted on 8-in. by 10-in. tracing cloth, for each floor of the building and its annex, the machine layouts existing and proposed. The location of all shafting, pulleys, belts and other equipment which would be eliminated by the installation of central-station service was shown in dotted lines. On each sheet below the machine layout diagram a 4-in. by 8-in. space was left blank, upon which the key to machine numbers, motors, etc., could be typewritten when the tracing was blueprinted. The reduction in shafting and belting could thus be seen at a glance, as shown in the accompanying typical layout sheet for the basement. In this case a hoisting winch, three grinders, a tumbler, a blower, a boiler-feed pump and an air compressor would be driven in two groups, motor A, of 7.5-hp rating, caring for all tools except the boiler-feed pump, which is scheduled for operation by motor B, of 1-hp rating. The speed of the main shafting is also indicated.

As an instance of the improvements to be effected by the use even of group motor driving, the sheet shows that with this installation the former steam engine would be eliminated, with the two pulleys, shafting and two belts which run the machinery on the first floor, besides a large pulley and belt required by the shop annex. The withdrawal of this equipment would result in a cut in the basement shafting as indicated on the print and consequent improvement in the driving conditions from the friction standpoint.

On account of the large number of small machines in the plant, space need not be taken here to reproduce the complete list, but some of the features of the proposed installation deserve mention, especially in connnection with the capabilities of electric service in simplifying the driving conditions. On the first floor three motors, aggregating 13 hp, are required to drive the various drills, boring mills, planers and lathes in three groups.

The survey indicated that here the shafting could be cut in three places, establishing a convenient sectionalization for sub-department overtime service. Five pulleys and belts serving other floors are eliminated by the introduction of

the electric drive. On the other floors the proposed layout for electric service does away with long runs of shafting transmitting power to distant departments, notably in the supply of service to a few machines located in the basement annex and in the removal of quarter-turn belts and other inefficient arrangements. On the first floor annex, for example, a group of three planers formerly driven by a quarter-turn belt would be operated by a 5-hp motor independently of the main shafting in this portion of the building. Elsewhere the study showed that different motors could be arranged to divide loads between them, enabling the overload characteristics of individual machines to be utilized in emergencies.

By actual test it was found that the friction load in the building was 30.4 hp, or 55 per cent of the maximum power demand. The relative cost of steam and electric operation was estimated as follows:

Cost of steam operation (average hp, 45; hours per week, 55; hp-hr. per year, 128,700; maximum, 55 hp):	
288 tons of coal, at $4.85	$1,396.80
Engineer, at $15 per week	780.00
Oil, waste and supplies	75.00
Repairs	75.00
Insurance (boiler and accident)	20.00
Interest (5 per cent), depreciation (6 per cent) on investment of $4,000	440.00
Removal of ashes	50.00
Gas and supplies for gas (owner and tenants)	120.00
Net steam drive cost	$2,956.80
Cost of operation as estimated (average hp, 35; hours per week, 55; maximum, 50 hp):	
Electrical service from local central station	$2,057.40
Coal for heating, 75 tons, at $4.85 per ton	363.75
Labor, lamps, renewals and motor oil	225.00
Interest (5 per cent), depreciation (6 per cent) on investment of $3,200 (67 hp in motors, lighting transformers and meters, $2,400; 230 lamps, wiring and installation of apparatus and shafting overhauling, $800)	352.00
Gross cost of electrical service	$2,998.15

The investigation showed that the owners of the factory could count upon a net sale of electricity amounting to $415.48 to tenants, leaving a net cost of installing and operating the electric drive of $2,582.67 and giving an estimated annual saving of $374.13 over present costs.

Colored-Tab System of Customers' Records

A contract-card file of all its customers, both past and present, is kept by the Consumers' Electric Light & Power Company, of New Orleans, and with the aid of a simple system of color tabs devised by the manager, Mr. Thomas Rhodes, is of the greatest service in tracing the history of any given customer, character of his service, etc. The card form of contract is used by the company, these cards being filed in cases in the order of streets and street numbers.

APPLICATION FOR ELECTRIC SERVICE

To CONSUMERS ELECTRIC LIGHT AND POWER COMPANY, New Orleans, La. 191

You are hereby requested to supply (subject to the Rules and Regulations endorsed hereon, which are hereby made a part of this contract) electric current to an equipment of ..... installed at No. ..... Street, New, Orleans, La., occupied as .....

provided that the Consumer shall place in premises a perfectly insulated installation of interior wiring and shall furnish a certificate from the City Electrician and an inspection bureau or agency recognized by the majority of insurance companies in New Orleans, La., that the electric equipment in premises has been properly done and is safe, and the Company is hereby released from all claims for damages resulting from the use of electric current when such certificate has been issued.

The Consumer agrees to allow the Company, the exclusive privilege of furnishing electricity for electric pow

COLORED-TAB SYSTEM OF CUSTOMERS' RECORDS

The name of the salesman securing the business is indicated by affixing red, white and green clip-tabs temporarily to the right-hand side of the corresponding contract card. Under the city electrical ordinances installations may be made and temporarily continued in service three months, during which period an inspection must be made before the final approval for continued service is given. Condition of inspection is therefore indicated on the contract cards by the position of the salesmen's credit tabs. A tab on the right shows that the installation has not yet been noted, but as soon as approval is conferred the clip is transferred to the left side, completing the record. At the center of the "disconnected" cards (filed with the rest) are affixed the master tabs which give information concerning former customers not now connected to the company's lines. A yellow clip shows that the house is vacant; blue, customer using gas; pink. customer using competitive electric service, and double clips, disconnected for non-payment of bill. Some of the earlier contracts were taken in standard sheet form, but these are also represented by card duplicates in the customer's file, the same system of tabs being applied.

"It Is as Easy to Start an Electric Motor as to Stop a Gas Engine"

In going after motor load at Arlington, Wash., population 2000, the Jim Creek Water, Light & Power Company has adopted the telling slogan: "It is as easy to start an electric motor as it is to stop a gas engine." Already the company has eight motor users, besides a 600-hp motor in service seven hours daily pumping the city water.

Recently Mr. E. G. Robinson, local manager, ran an effective advertisement in the two local newspapers which gave good results, as it was especially adapted for use in a small community where all know one another. At the top of a three-column display space appeared the line "Electric Power," and below at the right was a list of satisfied motor users. Paralleling this on the left was a second column headed "List of Dissatisfied Motor Users," the space beneath being, of course, blank. "This gave every prospective patron a list of our motor-service customers," said Mr. Robinson, "so that he could make a personal investigation to see if it was hot air we were handing out."

Ice-Making and Refrigeration from the Central Station Viewpoint

Mr. C. H. Stevens, manager of the power engineering bureau of the Edison Electric Illuminating Company of Brooklyn, contributed a paper to the recent International Congress of Refrigeration in Chicago which is of interest to electrical men. It is entitled "Artificial Ice-Making and Refrigeration from the Standpoint of the Central Station." The author said that it has only been within a comparatively short time that the field of refrigeration has received the specialized treatment from electric-service companies that it deserves. At the present time, however, several companies have reached the point where the word "super-specialization" would best apply as expressing the intensive manner in which they are going after the business. Some of the larger companies now employ refrigerating engineers to advise customers so that the best economy and efficiency may be obtained. Mr. Stevens gave three reasons why these efforts are made. The first is the load-factor of refrigeration and ice-making, which is materially higher than that of the average business. In the second place electric-service companies believe that before long artificial refrigeration will be used, at least to some degree, in practically all types of buildings. They also believe that natural ice will soon be entirely superseded by artificial ice, in the cities at least. This development will require a tremendous amount of energy, and it therefore opens up an almost unlimited field for the use of electricity. As the central stations are, as a rule, in a position to produce energy more cheaply than individuals, they should be able to get this business if they are willing to sell the energy at a small margin of profit. This constitutes the third reason for the interest in the subject by central-station managers.

The author explained some of the systems of charging for central-station energy and pointed out how the long-hour service and high load-factor of refrigeration and ice-making enabled this class of business to earn a cheaper rate than the average manufacturing process.

Data on Electrically Operated Refrigeration Plants

Data on twenty-five electrically driven refrigerating plants supplied with central-station energy were given, as in Table I. These figures were summarized in relation to consumption of energy as shown in Table II.

In general the energy consumption per cubic foot of storage room increases as the volume of the rooms and size of plants decrease. The fur-storage plant is an exception, and this can be explained by the fact that the contents of the room are changed but once a year.

Up to about two years ago practically all ice plants of large size were operated by steam engines. This was due to the fact that usually the plants were making ice from distilled water, obtaining the greater part of the distillate from the exhaust from their engines. With this handicap of the engine exhaust to overcome, the central station did not consider the field of sufficient importance to adopt new rates to apply directly to this business.

At the present time, however, there are in this country at least twelve artificial ice plants of over 90 tons rating

TABLE I—DATA ON REFRIGERATING PLANTS

Name	City	Connected Hp	Tons	Cu. Ft.	Kw-yr.	Kw-yr. per Cu. Ft.	Temp. of Cooler, F.
Wholesale meat markets:							
Swift & Co.	Philadelphia	15	8	22,980	25,728	1.12	...
Schwarzschild & Sulzberger	Philadelphia	10	6	15,732	30,448	1.93	...
Armour & Co.	Philadelphia	25	15	21,384	42,636	2.00	...
A. Booth & Co.	Chicago	30	12½	23,190	30,456	1.31	20
Lake Superior Fish Co.	Chicago	10	7	7,690	14,880	1.93	20
Withheld	Pittsburgh	50	20	94,000	159,250	1.69	30
Packers:							
Vienna Sausage Co.	Chicago	30	15	4,340	6,000	1.38	36
Sulzberger & Sons	Pittsburgh	30	15	39,680	76,292	1.93	36
Kingan & Co.	Pittsburgh	30	15	37,450	171,144*	4.61	40
Schwarzschild & Sulzberger	New Orleans	30	15	54,500	51,372	0.944	35
Provisions:							
S. Ershowsky	New York	15	8	10,505	23,412	2.24	36
P. Ohl	New York	7½	4	2,004	10,503	5.2	34
John J. Felon & Co.	New York	10	4	38,880	25,783	0.665	38
C. Sehnek & Co.	New York	5	2	504	5,613	11.1	25
George S. Sloan	Chicago	10	6	2,600	10,620	4.1	20
George Middendorf & Co.	Chicago	15	8	8,820	12,204	1.38	41
Retail meat:							
J. J. Schnitzius	Philadelphia	15	8	3,000	9,949	3.3	35
N. Frey	New Orleans	7	2	1,490	4,600	3.1	...
Klein Bros.	Chicago	15	8	4,629	26,808	5.8	36
Zambreno Bros.	Chicago	5	2	1,706	3,408	2.0	43
F. P. Bell	Philadelphia	7½	4	2,500	11,099	4.45	..
Fur storage:							
Balch, Price & Co.	Brooklyn	39½	20	56,775	19,760	0.35	30
Julius Klugman	New York	7½	4	5,722	1,931	0.34	20
H. Jaeckel & Sons	New York	15	10	33,120	23,000	0.70	16
C. G. Gunther's Son	New York	30	15	40,500	27,321	0.67	32

*No. 9 has two compressors.

which are operating exclusively on lighting circuits. They give the highest satisfaction, both as to efficiency and economy. The determining factors which brought about this change were the use of multiple-effect evaporators in connection with the distilled-water plants and the advent of the raw-water system of making ice, central-station rates applying directly to the latter system. The mutliple-effect evaporator is an efficient piece of apparatus. Very high evaporations are obtained, in some cases as high as 50 tons of distillate per ton of coal with an eight-effect evaporator. This makes it entirely feasible to drive the compresssors and pumps electrically and to produce the distilled water economically direct from the evaporators. The advent of the raw-water system was a still further advantage. In this system the obtaining of distilled water is a secondary and unimportant item, and with it the question of energy becomes simply a matter of rates, comparing various sources of energy.

Mr. Stevens explained the off-peak system of charging to show that this plan offers a method of obtaining still lower rates for the energy needed in refrigeration and ice-making. If the manufacturers of ice will shut down their

TABLE II—ENERGY CONSUMPTION OF ICE-MAKING PLANTS

Kind of Plant	Number Plants Averaged	Average Kw.-Yr. per Cu. Ft.
Fur storage	4	0.51
Packers (meat)	4	1.41
Provisions (large dealers)	3	1.43
Wholesale meat (Middle West)	3	1.64
Wholesale meat (Philadelphia)	3	1.68
Retail meat	5	3.73
Provisions (small dealers)	3	6.80

compressors during the months from November to February between the hours of say 3 to 9 p. m., the electric-service companies will be enabled to make rates that will make the operation of the electrically driven ice plant economical.

Ice plants electrically driven from central stations have several advantages. These are enumerated by the author as follows: First, continuity of service; second, saving in initial plant investment, ranging as high as 70 per cent in raw-water plants; third, increased facility for economical expansion of the plant; fourth, location of the plant at any point desired independent of fuel supply; fifth, saving of space devoted to boiler-house equipment and coal storage; sixth, entire elimination of the appearance of oil in the product; seventh, freedom from the worry and trouble of power-plant operation.

The majority of motors used are of the alternating-current type, and their economical life is longer than that of any other prime mover. Variable-speed motors have been used with success, but general practice seems to indicate that the greatest over-all efficiency, even at varying loads, is obtained by using a constant-speed motor. For driving the auxiliary apparatus electric motors are ideal

TABLE III—SUMMARY OF REPRESENTATIVE ICE PLANTS USING CENTRAL-STATION POWER

Plant	Rated Capacity per Day, Tons	Total Connected Load, Hp.	Yearly Ice Output, Tons	Annual Kw-hr.	Average Kw-hr. per Ton of Ice	Months of Operation
Knickerbocker Ice Co., 61st St. plant, Chicago.	120	564	37,205	1,457,912	44.7	8
Webster-Citizens' Co., Buffalo, N.Y.	90	427	33,002	1,444,608	43.7	12
Lincoln Ice Co., Chicago	120	511	27,839	1,455,012	52.2	12

because of their compactness, freedom from vibration and general adaptability to widely varying conditions.

In conclusion Mr. Stevens gave some data on three electrically driven ice plants which have been described in the *Electrical World*. These plants are supplied with electrical energy by the Commonwealth Edison Company of Chicago and the Cataract Power & Conduit Company, of Buffalo. These figures are summarized in Table III.

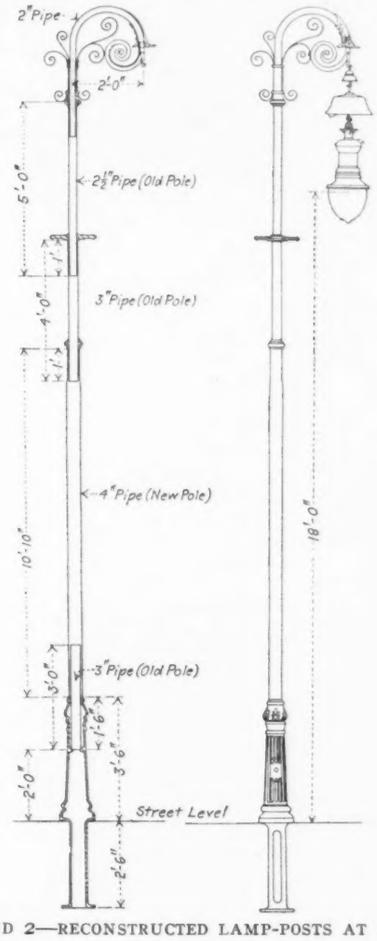
The average energy consumption for the three plants given is 46.89 kw-hr. per ton of ice produced, and this has been found typical of American practice in modern electrically driven plants.

Illumination and Wiring

Raising the Height of Old Inclosed-Arc Lamp-Posts at Cincinnati, Ohio

The large number of inclosed-arc lamps which formerly lighted the streets of Cincinnati, Ohio, were recently replaced with 6000 4-amp magnetite units, but the new high-powered illuminants when hung from the posts which carried the older lamps were found to give trouble and even discomfort from glare in the eyes of passers-by. This difficulty had not been apparent with the former low-powered units, but became so critical with the initial trial installations of the magnetite lamps that it was found necessary to raise the posts by about 7 ft. 6 in. and so increase the visual angle.

The sketches herewith show how this change was accomplished by first sawing in two the old shanks and then socketing these stumps into pieces of 4-in. pipe, 10 ft.



FIGS. 1 AND 2—RECONSTRUCTED LAMP-POSTS AT CINCINNATI, OHIO

10 in. in length. The original standards were of 3-in. pipe, which was found to fit snugly inside the 4-in. extension piece. An ornamental cap was added at the top of the extension to make a neat-fitting joint. Above this point the old poles were tapered into 2.5-in. pipe, and again to 2-in. pipe to form the curved neck.

The reconstructed poles place the point of lamp suspension at a height of 21.6 ft. above the pavement level, bringing the arc itself at a height of approximately 18 ft., well out of the way of direct vision.

The accompanying illustrations show respectively the sectional construction of the rehabilitated posts and their appearance when the work of raising and reconstructing them had been completed.

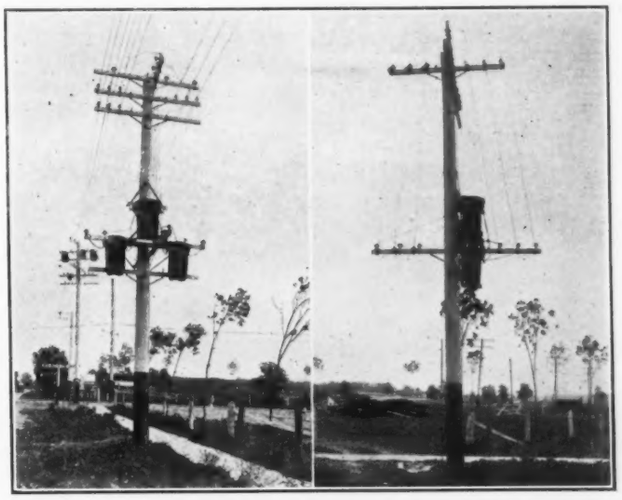
Tacks and Nails as Linemen's Hazards

There is a great need in most states of an amendment to the criminal code making it an offense to drive nails or tacks in poles which men have to climb, declared Mr. John B. Fisken, superintendent of light and power for the Washington Water Power Company, Spokane, Wash., in an address before the recent Northwest Electric Association convention at Seattle. Many a man, he added, has been injured by coming in contact with a rusty tack or nail sticking out from a pole. Sometimes tacks are used with heads ½ in. in diameter. If a lineman should happen to strike one of these with his spur, it would very likely cause him to fall. The city of Spokane has an ordinance making it an offense to tack signs on a pole, although it has not always been enforced.

Construction Practice on 13,200-Volt Transmission Lines in Wisconsin

Among the line extensions and newly constructed transmission circuits which The Milwaukee Electric Railway & Light Company has under way in the State of Wisconsin is the 13,200-volt, 60-cycle, three-phase line which is to connect Racine with Kenosha. No. 0 stranded-copper conductor is being used, and, except for ground wires, the construction follows the standard employed elsewhere by the company on its other extensions.

Although the line will not be finished until next spring, two large industries between South Milwaukee and Racine are already being furnished with energy from it. One customer is the Case Thrashing Machine Company at Racine, and the other is the Ives quarry of the Universal Crushed Stone Company, north of Racine. The former load is supplied through a 400-kw transformer, while the latter



FIGS. 1 AND 2—FRONT AND SIDE VIEWS OF POLE SUPPORTING TRANSFORMERS AT WATERFORD, WIS.

customer purchases his energy at 13,200 volts, stepping it down to 488 volts through one 400-kw and one 200-kw, three-phase transformer installed in a special small building. The crushed-stone company uses electricity exclusively for operating all its machinery.

Waterford, Wis., a town of about 1500 population, which is on the Milwaukee company's 13,200-volt line between West Allis and Burlington, is now supplied with transmitted energy. The local plant was recently taken over by the central-station company and is now being used as a substation. On the pole where the line feeding Waterford taps onto the main line Matthews fuse switches are installed, and a lightning arrester is connected onto one phase.

Running at right angles to the 13,200-volt line is the transmission line supplying the town. At the first pole from the main line nearest the town there are mounted three transformers which step the pressure down to 3300 volts, at which it is transmitted to the substation previously mentioned. Two of the transformers have a rating of 15 kw and the other is rated at 25 kw. The group is connected in delta so as to feed both the local three-phase motor circuit and a single-phase lighting circuit.

The upper cross-arm of the pole on which the transformers are mounted supports a short jumper line which connects with the 13,200-volt main transmission line. The two cross-arms below it support 3300-volt lines. The primary drops are carried down to the transformers on the opposite side from the 3300-volt drops, in order that linemen may not come in contact with them when inspecting the transformers. Rochester, Wis., a town of some 500 population, which is about two miles from Waterford, is also supplied with energy from this line.

The Value of Proper Show-Window Lighting

The Public Service Electric Company, of Newark, N. J., has just issued an attractively printed booklet on show-window lighting, containing both striking photographs and telling text. The value of window displays is attested by several actual incidents, and some of the paragraphs are reproduced herewith:

"A department store in Baltimore has a men's hat department. As is customary, this department formerly received only its pro-rata share of the newspaper advertising and show-window display. The department buyer, being dissatisfied with the amount of sales, offered to give up his share of the newspaper advertising if he could have instead a permanent window display. In six months, without any change in sales force and with no other form of advertising, the sales of that hat department had doubled, and today it is one of the best-paying departments in the store. The increase in its sales was due entirely to the selling power of constant, effective window displays."

"The most important part of the construction of a show

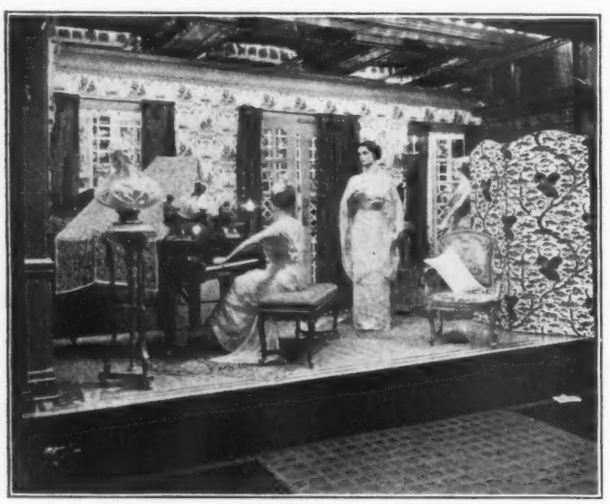


FIG. 1—DECORATIVE ILLUMINATION APPLIED TO SHOW WINDOW

window is the lighting equipment. Even the best display will fail to attract attention if it is not properly lighted, and correct lighting will increase the attractiveness of any display.

"To prove the value of lighting alone, the manager of a store on Forty-second Street, New York City, recently removed all the goods from his show windows. Then he covered the ceiling of each window with 100-watt tungsten lamps equipped with focusing reflectors. That evening he placed men behind screens to count the number of people who stopped to look at the windows. He wanted to test the attractive power of light.

"By actual count no one passed the windows without looking at them, and during the early part of the evening there

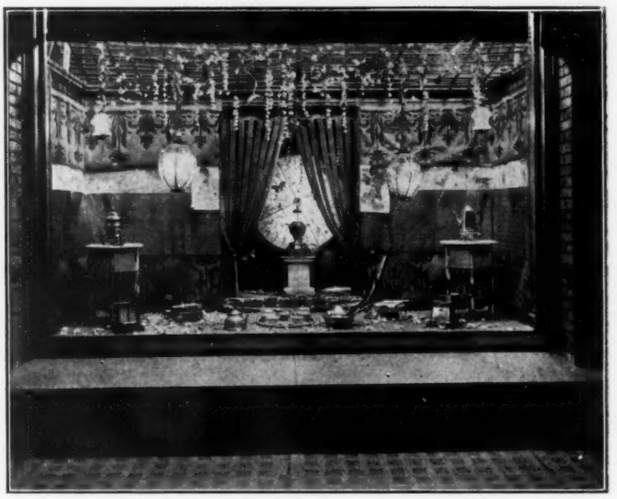


FIG. 2—A DISPLAY THAT ATTRACTED 72 PER CENT OF THE PASSERS-BY

were always from three to five people standing in front of the windows, wondering at the intensity of the light. Here is proof that light alone will attract attention on one of the most brightly lighted streets of the world, and proof that brilliant illumination will increase the attractiveness of show-window displays."

"With the right equipment it is possible to produce in the average show window the unusual and beautiful lighting effects that are produced upon the stage. When these lighting effects are added to or made a part of the display, a show window attains its greatest power to attract attention."

"By actual count, extending over four nights, a certain show window attracted the attention of 12 per cent of the passers-by. Then the lighting equipment was changed, and light was used in a decorative way as a part of the display. (See Fig. 2.) By actual count the window then attracted the attention of 72 per cent of the passers-by—an increase in value of 500 per cent, due to the attractive power of light. The difference in the cost of energy was only 2 cents an hour."

"A show window, then, is given its maximum advertising and selling values through the use of artificial light. It is fortunate that show windows are most attractive at night, because then the people on the street are less hurried and they are in a receptive mood. What they see makes a deep impression that lingers in their memory. Up-to-date merchants realize this and keep their windows lighted long after their stores are closed. The merchant who does not have his windows brightly lighted at night loses a good opportunity to increase his sales and gives his competitor a great advantage."

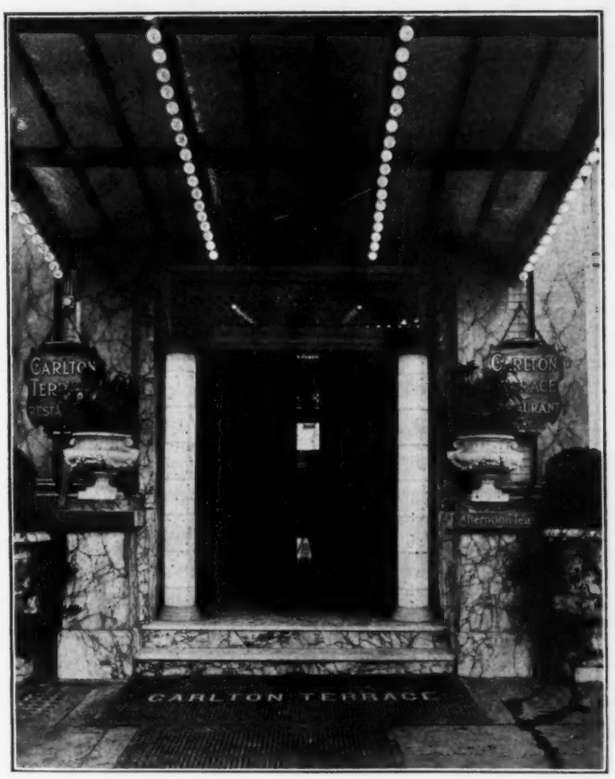
Fig. 1 herewith shows a recent window display of one of the John Wanamaker stores, reproduced from the Public Service booklet. The rear of the window was reconstructed to form part of the display, giving the effect of a lighted porch outside the music room. This window might have been made even more effective, suggests Mr. F. D. Pembleton, of the Public Service Electric Company's sales department, which is pushing the window campaign, if the equipment had been arranged to give a moonlight effect outside the lattice. Then by putting the window circuits on a

flasher the window lamps and piano lanterns might have been extinguished at intervals, leaving alternately the effect of moonlight streaming through the windows.

By actual count, as mentioned above, 72 per cent of the passers-by were attracted by the display illustrated in Fig. 2. The lanterns and parasols were made luminous, and blue light gave the effect of sky seen through the lattice.

A Pioneer Exterior Illumination Installation

The entrance to the Carlton Terrace Restaurant, Broadway and 100th Street, New York City, embodies a unique and striking lighting installation which presents a new avenue of possibilities for future progress in the science of exterior illumination. The accompanying picture gives only a faint idea of this installation's appearance at night when lighted. The two columns shown are hollow and of glass, fluted, and finished on the outside to a "near-marble" appearance, which, while not exactly deceptive in that respect, lends an attractive effect to the doorway in the daytime. Inside these columns are placed tungsten lamps, affording a large volume of soft light and brilliantly illuminating the entrance. A point worthy of consideration is



ILLUMINATION OF ENTRANCE TO CARLTON TERRACE RESTAURANT

the fact that the lighting system here installed makes use of an architectural unit not primarily associated in any way with the subject of illumination. The column has always been linked essentially with the idea of a supporting medium, and even these columns might be so used judging from their appearance in the daytime. Following along the line of thought thus opened up, if the column is adaptable to this treatment, it has been suggested that the idea be more extensively applied to stairways, vases, wall and ceiling panels, sidewalks and a variety of other units, both interior and exterior, which are not primarily associated with the idea of illumination but which are placed where illumination is desired. The Carlton Terrace, of which Slavin & Pike are proprietors, was designed by S. B. Eisendrath, of 500 Fifth Avenue, New York. The Lighting Studios Company, of 16 East Thirty-third Street, made this lighting installation.

Recent Telephone Patents

The prepayment plan of measured service has been applied to the automatic system by Mr. J. Erickson, of Chicago, Ill., who has assigned his patent to the Automatic Electric Company. After all the operations of making a call are completed the calling party is left in condition to hear the called party, but he cannot transmit his message until he has placed two coins in the coin box in succession. This releases a transmitter switch and conversation begins.

Mr. P. E. Erickson, of New York City, is the patentee of a protector of the open-space type which uses metal plates for the sparking surface. One plate of metal alloy and one of metal is used, the combination being such that little arcing occurs and the tendency to fuse is overcome. The patent is assigned to the Western Electric Company.

A glass mouthpiece is preferred by some for telephone transmitters. Such a mouthpiece has been patented by Mr. M. Rossenwald, of New York City, and Mr. J. C. Doran, of Danbury, Conn., the patent being assigned to the F. A. Weeks Manufacturing Company. A metal mouthpiece holder screws into the face of the transmitter. The glass mouthpiece proper carries an external ring molded at its base, and this ring is engaged securely by the metal mouthpiece holder after the fashion of a lamp chimney.

Mr. I. S. Rosenblat, of San Francisco, Cal., has invented an antiseptic mouthpiece, which has at its base a large circular case concentric with the sound passage. This case divides at a screw joint in its cylindrical wall. Antiseptic material is placed within the case.

Letter to the Editors

Strength of Transmission Towers

To the Editors of the Electrical World:

SIRS:—The comments of Mr. J. B. Leeper and of Mr. R. D. Coombs upon the tower design described by Mr. K. Nogami in your issue of Aug. 9 are very much to the point. There is no question among transmission-line engineers and construction men that designers of towers very often "go the limit" in order to make up a winning design.

Supplementary to the statements of Mr. Coombs in regard to the custom of using compression members with too great a ratio between l and r, the writer begs to call attention to the danger of going into extremes in decreasing this ratio and thus defeating one of the fundamental objects leading to the use of steel construction in the first place, namely, that of obtaining a low maintenance and depreciation cost. The writer refers to the dangerous practice of bringing down the l/r ratio and the weight of the structure by using members of fair size but of excessively thin metal. It is generally agreed that ¼ in. for the legs and 3/16 in. for the secondary members should be the minimum thicknesses of sections used in towers if an economical "expectation of life"—to borrow a life-insurance term—is to be realized. Towers have been used with corner posts having a thickness, or rather thinness, of only ⅛ in. It does not require even a rudimentary structural knowledge to appreciate the effect of the corrosion of a year or two on such members.

Mr. Coombs rightfully analyzes the situation when he states that the causes of such faulty design are unrestricted competitive bidding and the general custom of taking care of the transmission-line end of a "job" after everything else has been provided for.

Minneapolis, Minn. R. A. LUNDQUIST.

Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

Indicators Showing Condition of Screens in Condensing Water Intake

Where condensing water is obtained from lakes or rivers the screens in the intake pipes are liable to become covered with weeds and debris, thus reducing the amount of water supplied to the condensers and consequently the vacuum. Even where the screens are inspected periodically this trouble is liable to occur. A simple indicating mechanism is used by the Louisville (Ky.) Gas & Electric Company for ascertaining the free level in the intake and discharge tunnels from the condensers.

At its Waterside generating station the company obtains

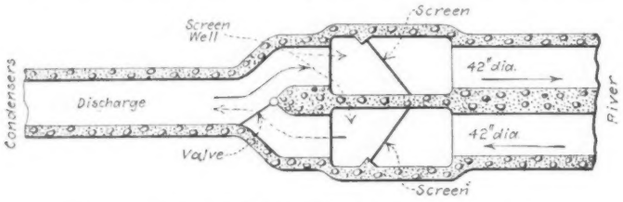


FIG. 1—PLAN OF CROSS-SECTION OF SCREEN WELL

the condensing water supply from the Ohio River through two 42-in. concrete pipes so located that they supply water to a screen well at all stages of the river. Fig. 1 shows a plan cross-section of the screen well with the concrete pipes from the river entering on the right and the intake and discharge tunnels leading to the condensers in the generating station opening to the left. The discharge tunnel is superimposed upon the intake tunnel, both of which can be connected with either compartment of the screen well. The screens in the well are placed diagonally so that as much surface as possible is presented to the incoming water. Fig. 2 is an elevation cross-section of the same well.

At the condenser end of the discharge and intake tunnels two open pipes communicate with the intake and discharge tubes, as shown in Fig. 3. In each pipe is a float connected to a tape running over a pulley and counterbalanced

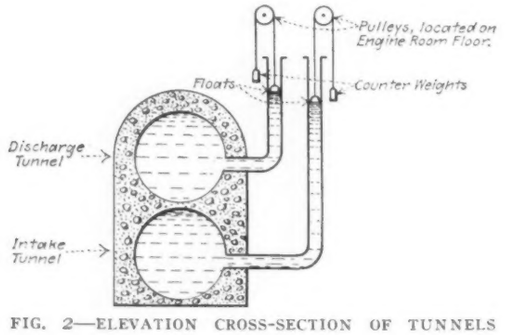


FIG. 2—ELEVATION CROSS-SECTION OF TUNNELS

at the other end. These pulleys are located on the engine-room floor, and any change in the free level of the water in the tunnels causes a corresponding rise or lowering of the float. The tapes attached to them being graduated in feet and inches are read at the same level periodically and the difference in readings represents the head of water required to force the water through the screens plus the friction loss in the pipes. When the screens are cleaned the difference in readings between the tapes can be taken as normal, and an increased difference shows that these screens need attention.

As these readings are recorded on the station log sheets the engine-room attendant is always informed as to the condition of the screens, and the operating engineer is able to tell whether the screen receives the proper attention. An

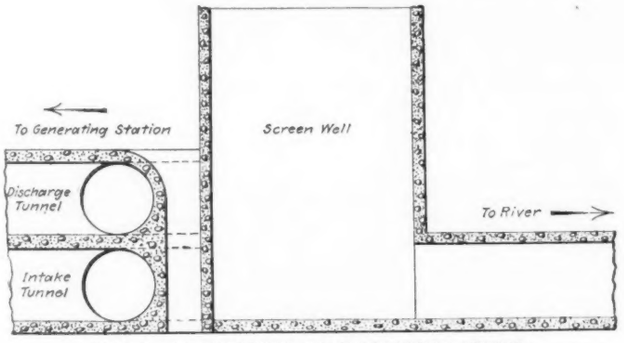


FIG. 3—CONNECTION OF INDICATING DEVICE

improvement of this indicating device is contemplated whereby the difference in free water level will be recorded on a roll of paper.

Oil Fuel for Steam Boilers

BY R. T. STROHM

At the rate at which oil fuel is being produced at the present time, there is no danger that it will supplant coal as a boiler fuel, except in a few localities. For if all the oil produced throughout the world in a year were used for the purpose of steam generation, it would furnish an amount of power equal to only about one-thirtieth of that annually required by the power and manufacturing plants of the globe. Therefore, unless far greater oil fields are discovered and the yearly yield of the wells is enormously increased, there is no danger that oil will become a general competitor of solid fuel in steam-boiler plants.

Nevertheless, there are localities in which oil forms a useful, economical and desirable fuel, and in which it is used to the exclusion of coal. Such localities are the regions in which the oil is produced. Yet there are oil fields in which little oil is used for steam-boiler fuel, because of the fact that the oil is more valuable for other purposes. Consequently, the factors that determine whether oil shall be used for fuel in preference to coal are as follows:

The price of the oil must be low enough to enable it to compete with coal in that particular neighborhood; the supply must be continuous and ample, so as to prevent shut-downs, and it must be of a quality that can be used without unusual difficulties in the furnace.

In the United States the greatest oil fields are located in three regions. The first of these embraces western Pennsylvania, Ohio and West Virginia. The second includes portions of Texas, Louisiana and Oklahoma. The third is in southern California. The oil that is produced in the first of these regions, however, is not used to any great

extent as a fuel for steam boilers, for the simple reason that it is of such quality and composition that it is more valuable for refining. Also, this same region contains great deposits of bituminous coal, so that it is more economical to use this solid fuel for power plants.

The oil produced in the second and third fields named above is also used in refineries, but a moderate proportion is employed for fuel in boiler furnaces. The reason lies in the fact that coal is scarce in either of these fields. That is, all coal used in these districts must be brought by rail or water from some distant point or points, with the natural result that the cost per ton is greatly increased. Because of this fact, it is far cheaper to use oil as the fuel, as it is found in the immediate vicinity and does not need to be transported over such great distances.

The oils that are used for fuel are forms of petroleum, which is the term that includes all the mineral oils derived from the earth. The characteristics of petroleum, such as color, density and odor, vary according to the region in which the oil is obtained. In some parts of the world petroleum is clear and without color, like water, and in other parts of the world it is black. The petroleum found

FIG. 1—HYDROMETER FOR DETERMINING DENSITY OF AN OIL

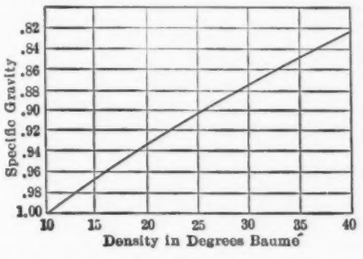


FIG. 2—CURVE USED TO FIND SPECIFIC GRAVITY FOR ANY BAUMÉ READING

in the United States is brown or reddish brown in color, as a rule, when in a tank or other vessel. But if a sample is poured into a glass or a bottle and is then held up so that the light can pass through it, the oil will appear to have a dark green color.

In spite of the differences in color and other characteristics, however, all petroleums are very much alike in composition; that is, they are all liquid hydrocarbons. The principal elements of which they are composed, and which make them valuable as fuel, are about the same as those in coal, namely, carbon and hydrogen; also, like coal, petroleum contains oxygen, nitrogen and moisture. The relative percentages of these constituents vary somewhat according to the locality from which the oil is derived. For example, an average Texas petroleum has 84.6 per cent of carbon, 10.9 per cent of hydrogen, 1.6 per cent of sulphur and 2.9 per cent of nitrogen. A sample of California petroleum, on the other hand, contains 85 per cent of carbon, 12 per cent of hydrogen, 0.8 per cent of sulphur, 1 per cent of oxygen, 0.2 per cent of nitrogen and 1 per cent of moisture. Thus, petroleum may be taken as having from 83 to 87 per cent of carbon, from 10 to 16 per cent of hydrogen, and trifling percentages of sulphur, oxygen and nitrogen. Those oils that contain sulphur usually have a disagreeable smell, due to the presence of the sulphur.

Although all oil used for fuel is derived primarily from petroleum, it may be obtained commercially in either of two forms, namely, crude oil and fuel oil. Crude oil is simply raw petroleum, in the condition in which it is obtained from the oil well, and is not subjected to any treatment. Fuel oil, on the other hand, is a residue; that is, it is the oil that remains when petroleum is subjected to a partial distillation.

The distillation process just referred to drives off the lighter oils contained in petroleum and leaves the heavier ones. The crude oil is put in closed tanks called stills and is slowly heated. Now, the crude oil consists of a mixture of a large number of liquid hydrocarbons having different densities and boiling points. Consequently, as the temperature in the still rises, these various oils are brought to the boiling point, one after another, and escape from the still in the form of vapor. The vapor is led through pipe coils and is chilled, whereupon it condenses and becomes liquid again.

At first, while the temperature rises from about 100 deg. Fahr. to 160 deg. Fahr., petroleum ether will be boiled off, this being a very light oil. From a temperature of 160 deg. Fahr. to about 175 deg. Fahr. gasoline will be distilled. Naphtha will be driven off while the temperature changes from about 175 deg. Fahr. to about 300 deg. Fahr., and from 300 deg. Fahr. to 570 deg. Fahr. the oil driven off will be what is commercially known as kerosene. The oil that remains in the still after the temperature has reached 570 deg. Fahr. consists of lubricating oils, paraffin and coke or asphalt. The crude oils found in the region of western Pennsylvania have a coke base, whereas those from Texas and California have an asphalt base.

The residue, or oil remaining in the still after the petroleum ether, gasoline, benzine and kerosene have been distilled, is what is frequently used as fuel for steam boilers and sold under the name of fuel oil. It is simply the oil remaining after the lighter oils have been driven off from the crude petroleum. The effect of the heating and driving off of the lighter constituents is to leave a residue that weighs more per cubic foot than the original petroleum; in other words, the density of fuel oil is greater than that of the crude oil from which it is obtained. Moreover, the distilling process causes a change in the composition of the oil. The percentages of carbon and sulphur are decreased slightly and those of hydrogen and oxygen are increased.

As the constituents of liquid fuel are the same as those of coal, the same formula may be used to calculate the heat values, or calorific values, of the two kinds of fuels; that is,

$$Q = 14{,}600\,C + 62{,}000\,(H - \frac{O}{8}) + 4000\,S,$$

in which Q = calorific value, in heat units per pound;
C = percentage of carbon, expressed decimally;
H = percentage of hydrogen, expressed decimally;
O = percentage of oxygen, expressed decimally;
S = percentage of sulphur, expressed decimally.

Thus, if a fuel oil has 83.3 per cent of carbon, 12.5 per cent of hydrogen, 0.5 per cent of sulphur and 3.7 per cent of oxygen its theoretical calorific value is:

$$Q = 14{,}600 \times 0.833 + 62{,}000\,(0.125 - \frac{0.037}{8}) + 4000 \times 0.005 = 19{,}845 \text{ heat units.}$$

This, it must be remembered, is but the approximate heat value, based on the chemical composition of the oil. A more reliable estimate of the heat value may be obtained by making a calorimetric test of a sample of the fuel oil.

The calorific values of oils vary according to the localities from which they are derived and range from about 17,000 to 21,000 heat units per pound. The Texas and California crude oils used in power-plant work seem to have a calorific value averaging about 18,600 heat units per pound.

Fuel oil and crude oil are usually not quite so heavy as water, bulk for bulk; that is, the specific gravity of oil is ordinarily less than that of water. As a general rule, however, in the purchase and sale of oil fuel the specific gravity is not directly mentioned; instead, it is implied by stating the density in degrees Baumé, or the reading of a Baumé hydrometer allowed to float in the oil.

The method of determining the density of an oil by means of the hydrometer is shown in Fig. 1. A sample of the oil is put into the deep glass *a*, and the hydrometer is lowered into the oil, in which it will float and soon come to rest. The hydrometer consists of a glass tube *b*, at the

lower end of which are the chamber *c* and the bulb *d*. The large part *c* is filled with air, and the bulb *d* is filled with quicksilver. The former causes the hydrometer to float, and the latter keeps it in an upright position.

The stem *b* is graduated with a series of divisions, the lowest one being marked 10. When the hydrometer is put in a vessel of pure distilled water, it sinks until the graduation marked 10 is even with the surface of the water. In other words, 10 deg. Baumé, or 10 deg. B., as it is usually abbreviated, corresponds to a specific gravity of 1, or the specific gravity of pure water.

When the hydrometer is put into a vessel containing oil that is lighter than water, it sinks farther than it did in water, and some other graduation greater than 10 comes even with the surface of the oil. The number of this graduation then indicates the density of that particular oil, in degrees Baumé. For example, if the graduation marked 26 came level with the surface of the oil, the density of the oil would be 26 deg. Baumé.

If the density of an oil lighter than water is given in degrees Baumé, the corresponding specific gravity may be found by using the formula

$$G = \frac{140}{130 + B}$$

in which G = specific gravity of oil;
B = density, in degrees Baumé.

For instance, if an oil has a density of 20 deg. Baumé its specific gravity is

$$G = \frac{140}{130 + 20} = 0.933.$$

To enable the specific gravity for any Baumé reading to be found quickly, without any calculations, the curve shown in Fig. 2 is given. For example, suppose that it is desired to find the specific gravity of an oil having a density of 19 deg. Baumé. On the horizontal scale locate the division corresponding to 19, which is the first vertical line to the left of that marked 25. From the point where this vertical line meets the curve follow horizontally to the scale at the left-hand edge of the diagram. It will meet the scale between 0.90 and 0.92, at a point that corresponds to about 0.905. This is the desired specific gravity. In other words, a Baumé reading of 25 deg. corresponds to a specific gravity of about 0.905.

The same diagram may be used to find a Baumé reading corresponding to a given specific gravity, by reversing the foregoing method. Suppose that it is desired to find the Baumé reading of an oil having a specific gravity of 0.91. Having located the point corresponding to 0.91, midway between 0.90 and 0.92 on the left-hand scale, follow horizontally to the curve and then down to the bottom scale. The point thus reached will be slightly to the left of 25, corresponding to 24. Hence, a specific gravity of 0.91 corresponds to a Baumé reading of 24 deg.

No Reason Why Hydroelectric Plants Should Suffer from Ice Troubles

In a paper on "Ice Formation" presented to the International Congress of Refrigeration in Chicago on Sept. 17-24 Dr. H. T. Barnes, professor of physics in McGill University, Montreal, makes this statement: "Frazil is formed most rapidly on the surface, but it appears also throughout the body of the river when the water is supercooled. The supercooling is never more than a few thousandths of a degree, but notwithstanding this, it produces great physical effects. It is during such a time that the ice becomes adhesive, agglomerated, and produces trouble to the operators of water-powers. The strength and tenacity of the frazil as long as the temperature remains below the freezing point is enormous. It wants but the very smallest change of temperature in the water, however, to make it soft and spongelike and easily disintegrated. The sun is the most powerful agent in imparting the necessary small fraction of temperature to the water to relieve ice troubles. Thus waterwheels which have been securely cemented during the night are soon running again the next day when the sun comes out. Artificial methods of heating have been developed which have proved remarkably successful. The most effective methods are those of Mr. John Murphy, of Ottawa, who has been studying the problem for many years. There is now no reason why any power plant operated by hydraulic means should suffer from ice troubles."

Rules for Installation of Suction Gas Producers

Are there any regulations hindering the installation of suction gas producers in buildings? D. W. E.

The Fire Underwriters permit the installation of suction gas producers of approved make having a maximum rating of 250 hp inside a building, provided the apparatus for preparing the gas is installed in a separate, inclosed, well-ventilated fireproof room. The installation of producers in cellars, basements, etc., requiring artificial light will not be countenanced except by special permission from the underwriters having jurisdiction.

Linemen's Gloves and Safety Belts

Should a company furnish its linemen with rubber gloves and safety belts or should a lineman be expected to supply these himself? I note from a recent discussion that the practice differs, some companies supplying them and others requiring the linemen to have pliers and belts. S. A.

The electric-light company should always supply the rubber gloves and insist on their being worn by men at work on lines. Inasmuch as the employers' liability laws of various states class the work of linemen as hazardous, in which class recovery is allowed in all cases irrespective of negligence, it is well for the company to supply belts and pliers also. A lineman might purchase an inferior belt because it is cheap; the company in whose employ he is cannot afford to do so.

Strength of Cross-Arms and Poles

Where can I obtain information concerning the relative strength of cross-arms of various common woods? Will the average arm break under the strain imposed by broken wires before the pole relieves the stress by falling? W. K. M.

Results of recent tests conducted by the Forest Service on six-pin 6-ft. cross-arms, 3.25 in. by 4.25 in. in section, show that the ordinary woods range themselves in the following order as regards relative strength:

	Average Maximum Load, lb.
Longleaf pine, 75 per cent heart	10,180
Longleaf pine, 100 per cent heart	9,780
Shortleaf pine	9,260
Longleaf pine, 50 per cent heart	8,980
Shortleaf pine, creosoted	7,650
Douglas fir	7,590
White cedar	5,200

In nearly all cases where cross-arms are tested under conditions approximating actual service failure occurs at the first pin-hole from the center. Knots and other defects at these points, especially on the upper side, are therefore to be avoided. The figures above quoted were for tests with downward loading, but careful estimates of side-tension, such as would be caused by broken wires, etc., show that the weakest cross-arm of the lot, white cedar, is capable of withstanding lateral pulls of over 4000 lb., which is far greater than any side loading that could be resisted by a pole. A 25-ft. pole with 7-in. top will withstand from 1300 lb. to 2200 lb. side pull applied at the top. A 35-ft. pole with 9-in. top is able to resist about 3000 lb.

Digest of Current Electrical Literature

Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

Generators, Motors and Transformers

Single-Phase Commutator Motor.—E. F. W. ALEXANDERSON.—An illustrated article on his single-phase commutator motor for trunk railways, which is a combination of the repulsion motor and the series motor with commutation poles. Illustrations are given showing the construction of the motor and the attention which has been paid to effective cooling. The armature acts as a blower, sucking the air through openings in the side of the frame. The motors of this kind which are in use on the New Canaan line of the New Haven Railroad assume in spite of the heavy traffic a temperature rise of only 60 deg. C. This is about one-half of the temperature rise attained by the old series motors which were replaced by the new type of motor. The weight of the motor is not greater than that of "certain direct-current motors which are in use on similar lines." A locomotive equipped with four 400-hp motors is also illustrated.—*Elek. Zeit.*, Sept. 4, 1913.

Synchronous and Non-Synchronous Reactance.—J. REZELMAN.—A continuation of his long illustrated series. In this instalment the author deals with the reactance of a turbo-alternator having a solid cylindrical rotor and summarizes the results obtained for various machines which had been previously analyzed.—London *Electrician*, Sept. 12, 1913.

Effect of Vibrations on the Magnetic Properties of Sheet Iron.—E. GUMLICH AND W. STEINHAUS.—An account of an experimental investigation in which it was found that continuous vibrations such as are unavoidable on railroads are liable to cause considerable deterioration in the magnetic properties of newly annealed dynamo sheets, decreasing the permeability and increasing the hysteresis loss.—*Elek. Zeit.*, Sept. 4, 1913.

Lamps and Lighting

Drawn-Tungsten Filament.—O. KRUH.—An English translation in abstract of his German paper noticed recently in the *Digest*.—London *Electrician*, Aug. 29, 1913.

Effect of Inclosing Globes on the Life of Metallic-Filament Lamps.—GUASTAF SUNDEN.—An article on the way in which the life of metallic-filament lamps is affected by outside globes. The author has found by experiment that metallic-filament lamps should be subjected to the effect of air-cooling and should therefore not be used with inclosing globes. Fittings for metallic-filament lamps should be without an outside globe and reflector. In this way the life of the lamp is considerably extended.—*Elek. Zeit.*, Aug. 28, 1913.

Metallic-Filament Lamps.—A note on a recent British patent (No. 14,048, 1913) of the Allgemeine Elektricitäts Gesellschaft. To improve the efficiency of metallic-filament lamps a substance capable of giving off oxygen at low pressure when the lamp is burning is introduced in the bulb before exhaustion. Suitable substances are oxides, peroxides, nitrates, nitrites, chlorates, perchlorates, chromates, bichromates, etc., but manganese superoxide and barium chlorate are found specially suitable. The only reaction product is tungsten trioxide, which is practically colorless and even when deposited on the bulb cuts off little light. As it is non-volatile, no increase in pressure takes place in the lamp.—London *Elec. Eng'ing*, Sept. 4, 1913.

Generation, Transmission and Distribution

Upper Silesia.—W. VOGEL.—In connection with the recent meeting of the German Association of Mining Engineers in Breslau an illustrated description is given of the development of electric power installations in the mines of Upper Silesia. The article contains historical notes. A résumé is given of the problems solved in this mining district on the use of electricity for mining, together with statistical data on the increase of these installations, which have resulted in making Upper Silesia an important electrical district of Germany. At the day of lowest load in 1912 the lowest consumption in Upper Silesia was 6800 kw; the highest consumption was 14,800 kw. At the day of highest load of 1912 the lowest consumption was 13,500 kw, and the highest consumption 34,100 kw. The load-factor is therefore good. There were imported into Upper Silesia during the last year electric products having a value of $4,000,000.—*Elek. Zeit.*, Aug. 28 and Sept. 4, 1913.

Traction

Electric Traction.—G. KAPP.—His address to Section G of the British Association for the Advancement of Science. The advantages of the various systems of electric traction, three-phase, single-phase and continuous current, are first dealt with, some details being given of lines which have actually been electrified on one or other of these systems. Figures with regard to electric traction on the main lines of the Italian State Railways are set out, while some information about the St. Gothard line is also given.—London *Electrician*, Sept. 12, 1913.

Installations, Systems and Appliances

Cost of Manufacturing Electricity.—H. M. HOBART.—The author presents the subject of the cost of producing electrical energy by first taking up in sequence the physical and chemical changes whereby the production is secured. Then he goes on to illustrate how great is the simplicity secured by the substitution of electrical units, in the early calculations, for those of the thermal-unit type. A direct comparison is made, item for item, of the costs of manufacturing electricity as generated by a steam-turbine-driven plant and by an internal-combustion-engine-driven plant. The costs are segregated according to the most approved methods of accounting, viz., production, investment and administration costs. A dissertation follows on the cost as influenced by load-factor, power-factor and character of the electricity demanded.—*Gen. Elec. Review*, September, 1913.

Paris.—J. REYVAL.—A fully illustrated description of the Northern and Southwestern central stations of the Paris Electricity Supply Company.—*La Lumière Elec.*, Aug. 21, 1913.

Wires, Wiring and Conduits

Free Wiring.—K. EILER.—An article describing the conditions under which the small central station in Gronau in Germany carries out electric installations with a system of free wiring. It is shown that the capital invested in this work yields a satisfactory interest. The new installations obtained in this way have been able to compensate the loss of energy consumption due to the introduction of metallic-filament lamps. The author thinks that a system of free wiring will be advisable in some cases where it is important

to increase the consumption of energy.—*Elek. Zeit.*, Sept. 4, 1913.

Rules for Insulated Conductors.—A translation in abstract of the 1912 rules of the German Association of Electrical Engineers for the construction, testing and application of rubber-insulated conductors, tested or not tested in water, and for lead-covered cables.—London *Elec. Review*, Sept. 5, 1913.

Electrophysics and Magnetism

Continuity.—Oliver Lodge.—His presidential address to the British Association for the Advancement of Science.—London *Electrician*, Sept. 12, 1913.

Constitution of Atoms and Molecules.—N. Bohr.—A second mathematical paper on this subject. The author endeavors to show that the application of Planck's theory of radiation to Rutherford's atom model through the introduction of the hypothesis of the universal constancy of the angular momentum of the bound electrons leads to results which seem to be in agreement with experiments.—*Philos. Mag.*, September, 1913.

Ions from Hot Salts.—O. W. Richardson.—An account of an extended investigation the chief object of which was the measurement of the specific charge or the electrical molecular weight of the emitted ions; but in certain cases other points which seemed to be of interest or importance were examined and recorded. The salts which were tested are iodides of zinc, cadmium, calcium, strontium, barium, ferric chloride, manganous chloride, calcium chloride and calcium fluoride. The salts of the alkali and alkaline earth metals emit in appreciable quantity only univalent ions Li, Na, K, Rb, Cs, Ca, Sr and Ba. However, zinc iodide and cadmium iodide emit bivalent zinc and cadmium ions respectively. Most substances, if not all, emit negative electrons when they are heated to a sufficiently high temperature. Certain salts possess the property of emitting negative ions at relatively low temperatures. In addition to the oxides, the following salts have this power: the iodides of calcium, strontium, barium and cadmium, calcium fluoride, calcium bromide, manganous chloride and ferric chloride. In general, the negative ions emitted by these substances are not all electrons but consist of a mixture of electrons and heavy ions. Calcium iodide appears to exhibit this property in a typical manner.—*Philos. Mag.*, September, 1913.

Absorption of Heat Produced by Emission of Ions.—H. L. Cooke and O. W. Richardson.—In a recent paper the authors have shown that when a current of negative electrons is allowed to flow from a heated filament of osmium there is an absorption of heat which is equal in amount to the energy required to drive the escaping electrons through a potential difference of 4.7 volts. The present paper deals with similar experiments which they have made with lime-coated platinum wires and with tungsten wires. The phenomena exhibited by lime-coated platinum wires do not exhibit any evident relationship with the theory of these effects. Their behavior is quite different from that of the osmium and tungsten wires. In the case of the latter substances the thermal changes which take place when the thermionic current is turned on or off all occur within a few seconds. With the lime-coated platinum wires, under otherwise identical circumstances, it was questionable whether the changes were complete in a time comparable with ten minutes. The precise nature of the changes also depended rather definitely on the mode of preparation of the lime-coated surface. The authors conclude that with lime-coated platinum wires the cooling effect sought, if present, is masked by a larger cumulative effect.—*Philos. Mag.*, September, 1913.

Heating Effect at the Cathode in Vacuum Tubes.—B. Hodgson and P. A. Mainstone.—An account of a careful investigation of the well-known effect that in vacuum-tube work the electrodes become heated during the discharge and that the cathode becomes hotter than the anode. The authors investigated the heating effect at the cathode. With normal glow the heat energy communicated to the cathode is proportional to the current. When the abnormal glow sets in, the heat given to the cathode increases more rapidly as the current increases. The authors also determined a certain ratio a/b. The maximum value that this ratio can assume is 1.0, when the current is carried by positive ions only. Should each positive ion in striking the cathode ionize and produce only one negative carrier, then the ratio 0.5 would exist. If more than one negative carrier resulted from each collision, the value of the ratio would be still smaller. According to measurements of the authors the ratio a/b is approximately 1.0, showing that at the cathode surface only a few corpuscles are engaged in carrying the current.—*Philos. Mag.*, September, 1913.

Electrochemistry and Batteries

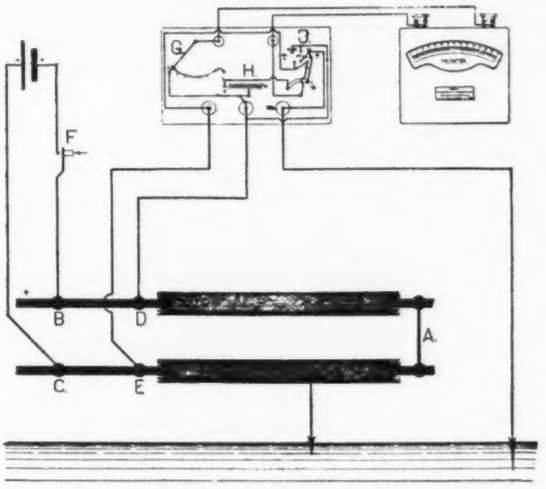
Smelting Copper Ores in the Electric Furnace.—D. A. Lyon and R. M. Keeney.—A paper read before the American Institute of Mining Engineers on the possibilities of the electric furnace in copper metallurgy. The authors conclude that the electric smelting of copper ores is nothing more than the substitution of electric heat for the heat derived from the combustion of carbon. Inasmuch as the carbon which is used either in the reverberatory furnace or in the blast furnace plays no important part in the necessary reactions which take place in these furnaces, there is no reason metallurgically why electric heat may not be substituted for the heat derived from the combustion of carbon. In some cases the reactions would take place to better advantage in the neutral atmosphere of the electric furnace than in the reducing or partially reducing atmosphere of the combustion furnace. Therefore, whether the electric furnace should be used for the smelting of copper ores would largely depend upon the relative cost of coke and electrical energy. The electric furnace for iron-ore reduction has been introduced as a matter of necessity on account of particular local conditions. The chances in favor of the electric furnace for the treatment of copper ores are greater than those for the treatment of iron ores, because there is not so great a difference in the cost of coke and electrical energy in copper-mining districts as in iron-smelting centers. Also the cost of electrical energy is constantly becoming less, owing to improvements in gas engines and steam turbines, so that in districts where water-power is not plentiful but cheap fuels unsuited to coking purposes are available it may be found more advantageous to use electric heat than the heat derived from the combustion of coke.—*Metall. and Chem. Eng'ing*, September, 1913.

Units, Measurements and Instruments

Magnetic Tests.—Friedrich Goltze.—In determining the watt losses in dynamo examinations it is desirable that the voltage curve used with the Epstein apparatus should approximate as closely as possible a sine wave. For this purpose the voltage drops in the whole alternating-current circuit must be made as small as possible. In the present paper, which is illustrated by numerous diagrams, the results of tests are given showing the magnitude of the voltage drops in the alternating-current circuit of a steel-testing plant and their effect on the wave-form of the magnetizing emf in the Epstein apparatus. Since a large part of all the voltage drops in the alternating-current circuit are due to the wattmeter used, measurements were made with different wattmeters which showed clearly the influence of the voltage drop in the wattmeter on the wave-form of the emf in the Epstein apparatus.—*Elek. Zeit.*, Aug. 21, 1913.

Location of Cable Faults.—An illustrated description of a very simple instrument for determining cable faults. If one of two cables placed side by side has somewhere an each fault, this is located as shown in the cut. The two cables are short-circuited somewhere at A so that a continuous cable from D to E is obtained. If the cable length

from D to A is, for instance, 84 m (277 ft.), the cable length from D to E will be 168 m (554 ft.). If now current is sent into the cable from a storage battery connected to the cable at the points B and C, the voltage drop from D to E is first measured. It is also possible to obtain the voltage drop from D to earth by turning a switch in the instrument. The ratio of the two readings gives the ratio of the total length of the cable to the distance of D from the



INSTRUMENT FOR DETERMINING CABLE FAULTS

earth fault. A control measurement is obtained by determining the voltage from E to the earth fault. The two distances determined in this way must then give the total length of the cable. A storage battery of high rating is used in order to get a current of 10 amp to 15 amp. For very low cable resistances it is necessary to insert a series resistance in the circuit. The connections of the instrument are self-explanatory from the diagram. The connection to earth is made, for instance, to the lead cover of the cable. A simple graphical method is used to find directly the distance in meters from the ratio of distances given by the instrument.—*Elek. Zeit.*, Aug. 21, 1913.

Testing Potential Transformers.—H. B. BROOKS.—A note on an investigation carried out in the Bureau of Standards. The commercial importance of instrument transformers has stimulated the development of accurate methods for the determination of their ratio and phase angle. A method is wanted which, while giving all needed accuracy, can be carried out at the point of installation, using commercial instruments and the ordinary supply voltage. Such a method of testing potential transformers is as follows: The primary windings of a standard transformer and the transformer to be tested are connected to the same supply. The secondary windings are connected in series so that their voltages are opposed. The small difference between the two secondary voltages is measured by means of an indicating wattmeter whose current coil is separately excited by a current in phase with the supply voltage. The ratio of the transformer under test may then be readily calculated. By making the above test with the primaries connected to a two-phase circuit, a measurement of the difference of the phase angles of the two transformers may be made by exciting the current coil of the wattmeter from the second phase. If a two-phase circuit is not available, the test for phase angle may be made by exciting the wattmeter current coil from another phase of a three-phase circuit and applying a simple correction factor. A comparison of the above method and a standard laboratory method gave values for ratio agreeing within less than 0.1 per cent, and of phase angle within one minute.—*Journal Franklin Inst.*, August, 1913.

Analysis of Periodic Curves.—S. SILBERMANN.—An article illustrated by diagrams in which the author develops the equations into which the Fourier series are changed when the periodic curves are plotted on so-called sine or cosine paper. The author then shows how the periodic curves can be resolved into single symmetric curves and the latter can be easily resolved into the fundamental wave and the harmonies. Numerical results are given to show the simplicity of this method of analysis.—*Elek. Zeit.*, Aug. 14, 1913.

Telegraphy, Telephony and Signals

Electric Fire Alarms.—W. FELLENBERG.—A continuation and the conclusion of his illustrated serial describing various types of fire alarms.—*Elek. Zeit.*, Aug. 28 and Sept. 4, 1913.

Miscellaneous

Aron.—An obituary sketch, written by Gottschalk, of the life and work of the late Hermann Aron, the inventor of the Aron electric pendulum meter.—*Elek. Zeit.*, Sept. 12, 1913.

Book Review

ALTERNATING CURRENTS SIMPLIFIED. By Elmer E. Burns. Chicago: The Joseph G. Branch Publishing Company. Cloth, 200 pages. Illustrated. Price, $1.50.

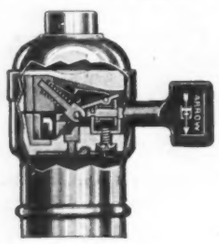
The subject of alternating currents is usually dealt with in mathematical language. Even in the few readable books on this subject where mathematical symbols and formulas are sparingly used, the author—either consciously or unconsciously—assumes the reader to be familiar with mathematical reasoning. In other words, the scientifically trained mind, capable of abstract reasoning, must be brought to the study of most books treating of alternating currents. Although he makes no direct statement to the effect that he is addressing the non-mathematical reader, the author of the book under review obviously wrote for the electrical worker who has not had the advantages of a university training or its equivalent. He has endeavored to present, in simple language, pictures of what is going on in the electric circuit under various conditions, and he treats of the elementary principles underlying the production and utilization of alternating currents. Mechanical and hydraulic analogies are given to illustrate inductance, capacity, phase differences and power-factor, while various appliances and systems of working are referred to and explained. There is no more difficult task than to produce a successful book on these lines, and there is no easier task than to criticise it by picking out the many points in which it fails of scientific accuracy. The author is certainly to be congratulated on having presented many apt and original illustrations of the actions taking place in alternating-current circuits, and on having done his work carefully and earnestly, with his fundamental purpose constantly in view; but it is not easy to estimate the real value of his book. It is undoubtedly difficult to know how far it is advisable to go in the popular presentation of this difficult subject, and it is just possible that Mr. Burns has gone too far in one or two directions. As previously stated, to dissect a book of this nature in order to expose minor inaccuracies would savor of quibbling; but the idea of any one conductor in a polyphase system acting as the return for all the others is certainly not clearly presented, and on page 143 the statement is made that in a two-phase circuit it is impossible to make one wire serve as the return circuit for the other two. The statement is enlarged upon, and the reason given has no reference to the upsetting of phase relations owing to the resistance of the common conductor; it is simply that the relation between the currents in the different wires is such that the thing cannot be done. In this matter of polyphase transmission the author has perhaps attempted rather more than could successfully be accomplished by his method of treatment.

New Apparatus and Appliances

An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

660-Watt Key Socket

The Arrow Electric Company, Hartford, Conn., has placed on the market a 660-watt key socket, with a quick-make-and-break mechanism. The accompanying illustration shows a sectional view of the socket, laying bare the

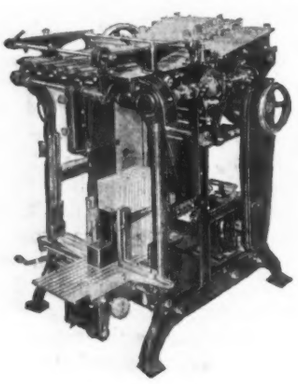


SECTIONAL VIEW OF 660-WATT KEY SOCKET

operating features of the device. The rapid development of energy-consuming devices has brought about the need of a socket with a higher rating than the ordinary key socket, and it is said that the new socket has been designed to meet the requirements of heating, cooking and other domestic service.

Rapid Folding Machine

The folding machine illustrated herewith folds paper three times in one operation and can make any of nine styles of parallel folds and three styles of right-angle folds. It can handle stock ranging in size from 18 in. by 24 in. to 25 in. by 5 in., and in grade from coated book paper to onion skin. The folded stock is automatically packed so that only one operator is required. The machine is capable



RAPID FOLDING MACHINE

of handling from 1500 to 7000 pieces per hour or from eight to ten times the output of a hand folder. The speed is adjustable to suit the work being done. The floor space occupied is 3 ft. by 4 ft.

The device is made by the American Folding Machine Company, Warren, Ohio, and is operated by a 0.25-hp Westinghouse motor.

Inductive Carrier System

At a demonstration in Paterson, N. J., Sept. 25, the Electric Carrier Company, of New York City, showed a model carrier system for transporting mail or packages in tubes without resorting to wheel traction. The driving equipment consisted of a three-phase induction motor, the secondary bar winding of which was extended the full length of the track. Two conductors of the system were carried in the tube above the cars. By means of these and the rails energy was supplied to a developed primary winding hung beneath the car at a distance of 0.375 in. from the bar winding. The tubes in the model system are 36 in. in diameter and the track contains one 20 per cent grade. The cars, weighing 1200 lb., carry 1000 lb. of sand over this grade at nearly synchronous speed.

Receptacles for Use on Wooden Molding and Pipe Taplets

The two receptacles shown herewith, which were primarily intended for use on wooden molding, have been changed so that they now may be used on pipe taplets as well. The change will in many cases simplify construction by allow-

RECEPTACLES FOR WOODEN MOLDING AND PIPE TAPLETS

ing the same type of receptacle to be used throughout the installation. The forming of the bases of the receptacles constitutes the only change which has been made from the standard line of their manufacturers, Pass & Seymour, Inc., Solvay, N. Y.

Oil-Engine-Driven Electric Welding Apparatus

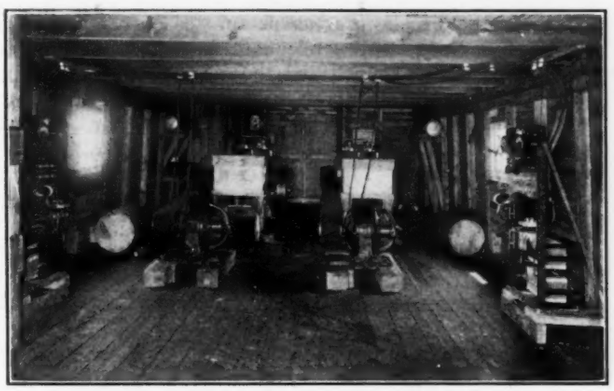
A very interesting branch of the electrical business carried on in New York Harbor, as well as in other important ports on the Atlantic and Pacific coasts and abroad, is that of repairing steamship boilers, plates, sternposts and other parts by means of the electric welding process. These repairs are made without placing the vessel in dry dock, which would involve heavy expense and loss of time. A barge carrying the necessary equipment is placed alongside the injured vessel, and the repairs are made in most cases while the ship is loading or unloading passengers and freight at her own dock. The advantages of this arrangement as compared with the old methods are obvious.

This business is carried on by the Siemund Wenzel Electric Welding Company, of 30 Church Street, New York, which has a fleet of barges busy day and night in New York Harbor and vicinity, making repairs of the above character at comparatively low cost. The deposition method which is used is the invention of Mr. H. L. J.

Siemund. The process consists in bringing the material to be welded to a pasty condition and simultaneously depositing metal from the fused metallic electrode. Since no preheating is necessary and practically no heating of plates occurs, this method is particularly suitable for high-class welding. An additional advantage claimed for this process is that the welded sections can be made of any desired strength by simply building up a thicker layer of metal.

In the accompanying cut is shown an interior view of the barge used in the above service. Its equipment consists of two welding generators each belt-connected to a 30-hp Remington oil engine. Each generator is of capacity sufficient to operate a single welding set, this arrangement being considered advisable in view of the character of the work in which it is employed. For stationary and shop outfits a larger size unit is generally used, with a capacity sufficient to care for half a dozen welding sets at once.

The vertical, two-stroke-cycle, semi-Diesel-type engine used in this service was selected for it because of its reduced cost of operation over steam or gasoline engine drive and because it is able to give close speed regulation under conditions of extremely variable load, such as the service involves. This is an oil engine in the strictest sense of the word, the oil consumed being introduced into the combustion chamber as a liquid and gasified within this chamber. The fuels used are kerosene, fuel oil and several kinds of low-grade oils sold under a variety of names. On the

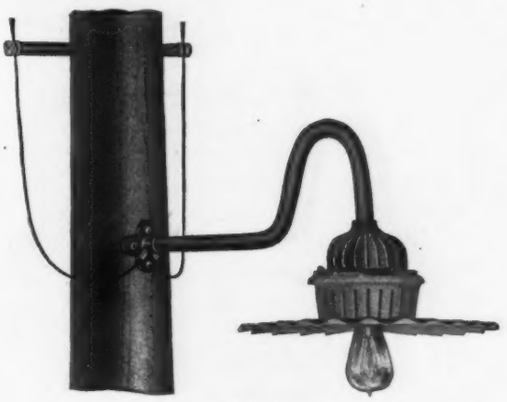


ELECTRIC-WELDING APPARATUS DRIVEN BY OIL ENGINE

crank shaft of the engine between the forward cylinder and the flywheel there is a cam which operates a set of fuel pumps, one for each cylinder. A centrifugal governor attached to the flywheel controls this cam, which turns with the shaft but slides back and forth upon it. This governor automatically sets the cam in a position which will adjust the stroke of the pumps according to the load on the engine. The fuel is sprayed into the combustion chamber under pressure, and into an atmosphere of compressed air of temperature sufficiently high to vaporize the charge. Comparatively low compression is used, which adds much to the life of the machine, and since combustion is less rapid than in gasoline engines, the machine is subjected to less severe shocks. It runs with little or no vibration, is good for continuous operation over a period of twenty-four hours if desired, and is easy to handle. The engine was built by the Remington Oil Engine Company, 120 Broad Street, New York.

Outdoor Lighting Fixture

The Line Material Company, of South Milwaukee, Wis., has placed on the market a street fixture which can be supported by gooseneck or straight pipe bracket, by rope or span suspension clamp. The casing consists of a heavy piece of porcelain with an iron top, and because of this heavy insulating casing the fixture, without the addition of another insulator, can be used for series circuits or multiple circuits. The casing is so arranged as to provide ample interior space for the socket; provision is made for an inner-wired or outer-wired fixture. For inner-wired fixtures the leads are brought through the iron casing at the top; for others the wires are placed through holes in the porcelain casing provided for the purpose.

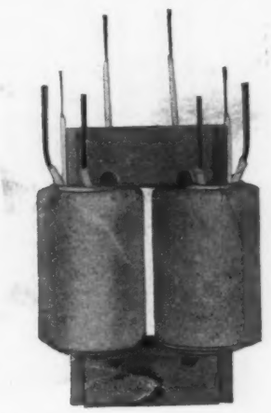


STREET FIXTURE WITH GOOSENECK SUPPORT

The porcelain-enameled fluted reflector is bolted to the porcelain casing, which in turn is secured by means of another set of bolts to the top iron casing. The reflectors are furnished in three standard sizes, of which the dimensions are respectively 18 in., 20 in. and 22 in.

Oil-Insulated Pole-Type Transformers

Four extra oil ducts have been provided for ventilating the interior of the transformers recently placed on the market by the Packard Electric Company, Warren, Ohio. The cruciform core used in all core-type transformers has four oil ducts on each core, but two of these are ordidinarily closed up by the yokes at the top and bottom. This difficulty has been avoided in the new product by giving the yokes the peculiar form shown in the illustration, which makes the four inside ducts available for ventilation purposes and insures a supply of cool oil in the interior of



TRANSFORMER WITH CASE REMOVED

the transformer where it is most needed. A special form of core is also used in the manufacture of these transformers which is designed to eliminate cross-magnetization. All secondary leads are brought out through a single strong porcelain bushing in order to reduce stray magnetism in the iron cases and improve the copper loss and regulation characteristics.

Portable High-Voltage Testing Sets

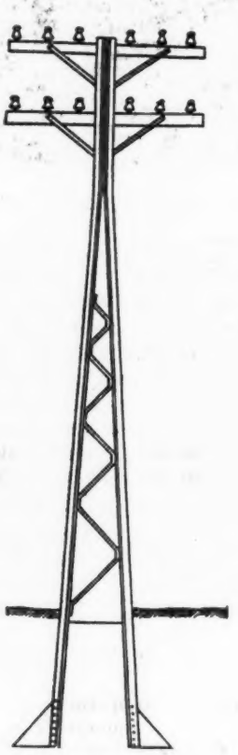
A portable high-voltage testing set which contains a 50,000-volt transformer, a variable resistance of the potentiometer type, electrodes, voltmeter, circuit-breaker, switch and pilot lamp is now being put on the market by the American Transformer Company, Newark, N. J. The transformer has a continuous rating of 2 kva and an overload rating of 5 kva for five minutes and may be operated at any frequency from 50 cycles to 125 cycles. The low-tension voltage is 100/200. A voltmeter coil with a raito of 1 to 500 is placed in the center of the high-tension winding, and leads from the coil are brought out to binding posts on the cover of the transformer. The transformer is oil-insulated and is mounted in a sheet-metal case, this construction affording minimum weight and maximum mechanical strength. The case is mounted on a removable truck provided with large swivel casters. The high-tension terminals are brought directly from the winding through heavily insulated bushings in the cover. The voltage-varying device used with this outfit consists of a fixed shunt resistance and a variable series resistance. The shunt resistance consists of a number of metallic resistance units connected across the low-tension terminals of the testing transformer. The terminals of this resistance are brought out to a connection board in such a way that they may be entirely disconnected from the circuit if desired. The variable resistance is of the compression type, operated by a hand-wheel. There are two distinct types of electrodes suitable for use with the standard testing outfit, either one of which is supplied as part of the necessary equipment. One form of electrode is suitable for testing oils and other liquids, while the other form is intended for testing samples of sheet insulation.

FIG. 1—PORTABLE VOLTAGE TESTING SET

FIG. 2—VOLTAGE TESTING SET ON TRUCK

Steel Poles for Distribution Lines

The Carbo Steel Post Company, Chicago Heights, Ill., has recently put upon the market two types of steel poles which are held to be practicable for use on central-station distribution lines and on telephone lines. The two styles are known as the uniped and the biped types. The biped pole, illustrated herewith, is used where leads are heavy, and it is said that a 30-ft. pole of this type when properly set will withstand a 1000-lb. pull at the top, although it weighs only 130 lb. The uniped poles are smaller and are used on light lines where there are few wires and where the height desired is less than 20 ft.



BIPED STEEL POLE

The claim is made by the manufacturers of these poles that, if all costs are considered, steel poles will be found cheaper than good wooden poles for any pole-line con-

struction. No concrete is used for setting the poles, and the depth of excavation recommended by the manufacturers is only two-thirds of that used in standard practice for wooden poles of the same height. The construction of the steel poles renders them easy to climb so that overhead work may be done without the aid of ladders or towers. The web at the base of the pole is said to eliminate the necessity for anchoring in many places.

Combination Rotary Converter and Synchronous Motors

Small rotary converters for charging storage batteries and furnishing energy to moving-picture arc lamps, which will operate at a reasonably high power-factor and efficiency without sacrificing the regulation, are being manufactured by the Northwestern Electric Company, Chicago. Several innovations have been made in the design of the converter, chief among which is the use of an improved form of magnetic damping ring inside of the pole pieces, which will prevent high voltages being induced

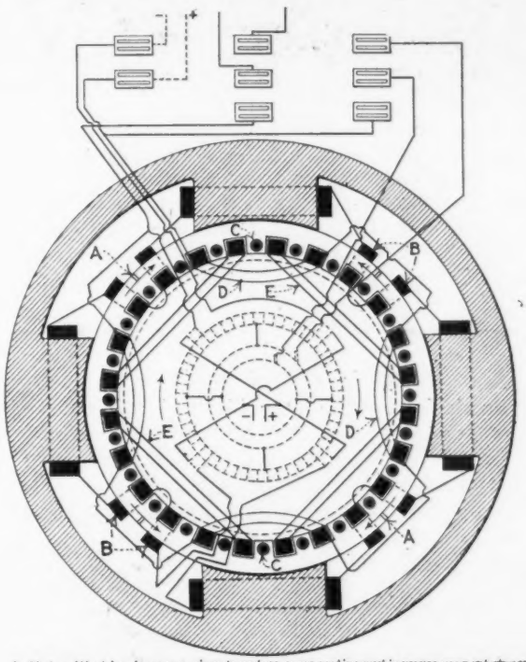

A
B
C
D
E
A = Slot milled in damper ring to reduce cross-section and increase mag. reluctance.
B = Portion of shunt field wound on ring to improve magnetic conditions in commut zone.
C = Squirrel Cage Bars.
D = Compensating Coils.
E = Starting Coils.

FIG. 1—DIAGRAMATIC SECTION OF SINGLE-PHASE MACHINE

in the field coils on starting, without increasing the magnetic leakage when running and thereby reducing the power-factor at which the machine operates. Because of the use of this magnetic damper, it is possible to connect the shunt-field windings permanently on to the direct-current brushes.

In Fig. 1 is given a diagrammatic section of a single-phase machine showing the starting switch and magnetic screen, which is slotted in order that coils may be wound on it to improve the characteristics of the machine. The machines are designed to operate on single-phase and three-phase energy as rotary converters or synchronous motors. Both the single-phase and three-phase converters are provided with compensating windings placed on a magnetic screen to improve the regulation and increase the starting torque. When designed to operate as motors, however, the compensating coil is omitted on the three-phase machines. The rotaries which are designed for operating on three-phase energy can be started from their alternating-current or direct-current terminals, but the single-phase units are started as series alternating-current motors.

In addition to the compensating coils, the single-phase machines are equipped with starting windings which are connected in series with the armature circuit when starting and are short-circuited when the machine reaches synchronous speed. This arrangement assists the compen-

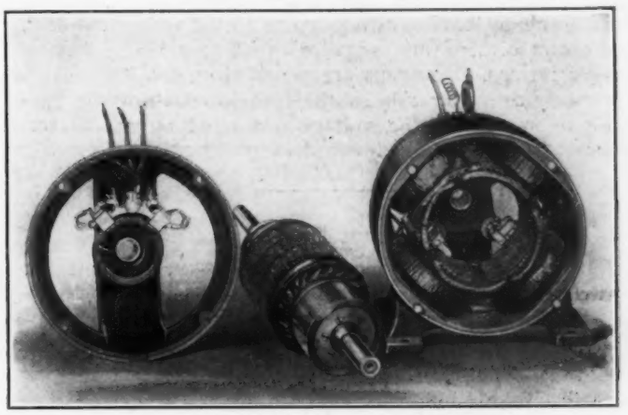


FIG. 2—DETACHED PARTS OF ROTARY CONVERTER AND SYNCHRONOUS MOTOR

sating coils and the squirrel-cage bars, which form the clamping rivets of the magnetic damper, in preventing surging of the magnetic flux, thereby maintaining practically constant speed.

Used without some sort of an auxiliary device, the advantage of the magnetic screen as a preventive of high-potential induced voltages in the shunt-field windings would be offset by the increased magnetic leakage occasioned by its inherent design. To improve magnetic conditions the damping screen is slotted midway between poles to reduce the cross-section and a coil of a few turns of wire is wound on either side of the slot so as to oppose the flux which tends to flow across the gap. These coils, which are connected in series with the shunt-field coils, do not prevent the flux from flowing through the damping ring during the period of starting. Where the over-compounding is required in special machines additional turns which are in series with the direct-current circuit may be wound over these coils and the desired regulation obtained.

The compensating and starting coils are arranged so as to assist each other in regulation, and when the starting

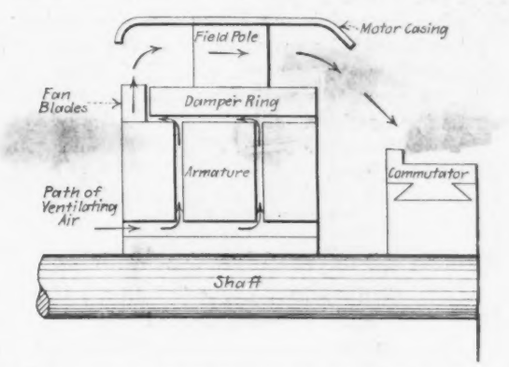


FIG. 3—DIAGRAM SHOWING PATH OF VENTILATING AIR

coils are short-circuited the pole-face area of the stator is increased thereby eliminating the necessity of working the pole pieces at a high density.

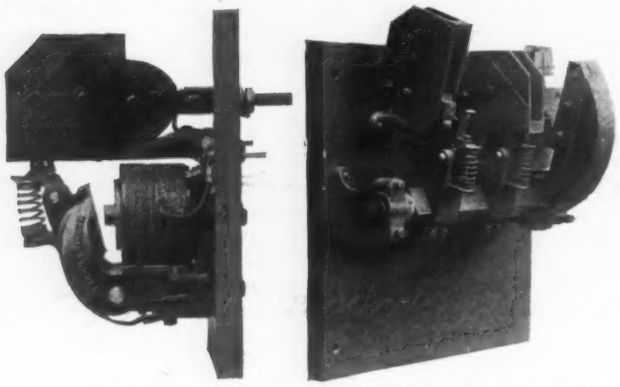
One of the peculiarities of this machine is that with lagging power-factors hunting can be eliminated, but with excessively high leading power-factors it has a tendency to hunt. Semi-closed skewed slots are employed in the

armature to insure quiet running. In addition to the features mentioned these machines are provided with a new type of forced ventilation, and the conductors connecting the direct-current brushes of like polarity are arranged to assist in supporting the brush holders. The diagram (Fig. 3) shows the direction which the air used in ventilating is forced to take.

Open-delta-connected auto-transformers are furnished with machines having ratings up to 10 kw and closed-delta auto-transformers are supplied with machines having larger ratings. Five taps are provided on the low-tension or rotary-converter side of the transformers for the purpose of regulating the voltage generated on the direct-current side of the machines.

Magnet Switches

The direct-current and alternating-current magnet switches for automatic controllers recently put on the market by the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., are of the clapper type arranged to be opened by gravity assisted by a spring. The direct-current switches are single-pole and the alternating-current switches are multipolar. Each switch is mounted on an individual slate base so that in case of accident an injured switch can be replaced immediately. The wearing parts, such as contacts, arc shields, etc., are in general the same in



FIGS. 1 AND 2—DIRECT-CURRENT AND ALTERNATING-CURRENT MAGNET SWITCHES

both alternating-current and direct-current switches of the same rating, thus reducing to a minimum the number of necessary repair parts.

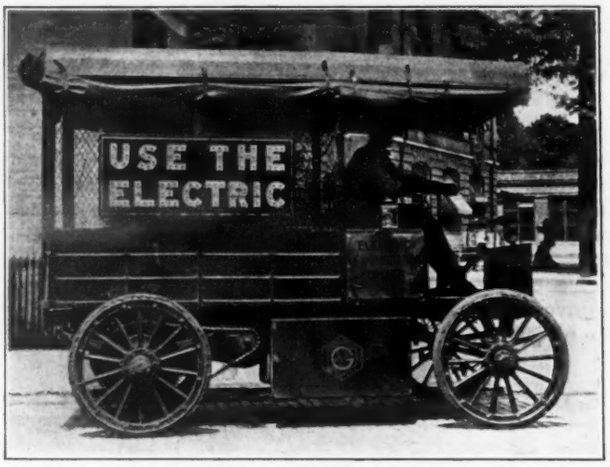
The arc when formed is not blown sidewise against the arc shield, but is guided upward by an arcing horn and is then extinguished by the blow-out coil. This arrangement preserves both the contacts and the arc shields. In switches of 250-amp rating and larger the circuit is made and broken between copper and carbon, but in all cases the final contact is between copper pieces.

Electric Signs to Advertise Vehicles

When the Meridian (Miss.) Light & Railway Company recently placed in service several General Vehicle trucks for its construction and maintenance work, Mr. C. A. Knight of the central-station company conceived the idea of placing small electric signs on the sides of one of the 1000-lb. vehicles. These signs are supplied with energy from the truck battery and advertise the central station, the electric-vehicle business and use of electric displays.

The signs were made in small panels 4 ft. long and 20 in. wide, reading, in two lines of 6-in. raised electric letters, "Use the Electric." The letters are fitted with candelabra receptacles and small tungsten lamps, the switch being controlled by the driver of the car.

Mr. Knight is quoted, however, as saying that the next vehicle signs installed will carry fewer lamps if possible, since the only drawback to the scheme has been its analogy to the famous small Mississippi River steamboat with the big whistle. When the boat ran they couldn't blow the whistle, and when they blew the whistle they couldn't run the boat. This difficulty has been overcome, however, in

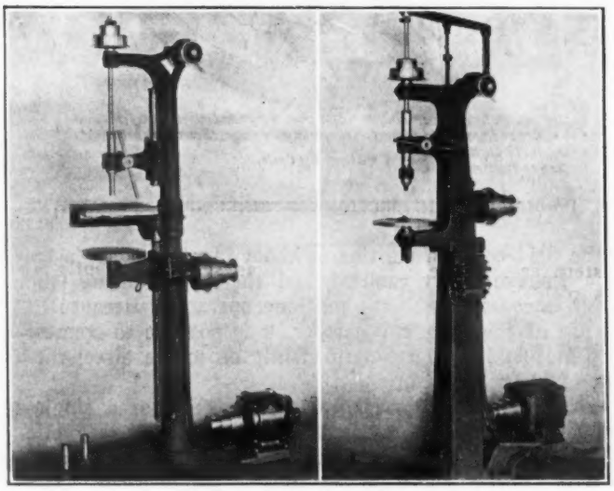


ELECTRIC SIGN ON TRUCK AT MERIDIAN, MISS.

the case of the electric truck by lighting the signs when the truck stops and turning them off again at starting. The signs are also lighted and used when coasting. The signs were furnished by the Greenwood Advertising Company of Knoxville, Tenn., and in finish match the maroon body of the truck.

Motor-Driven Drills

The two drills shown in the illustration herewith are modernized designs of machines that have been on the market for many years. Motor drive is one of their conspicuous features. The addition of the motor makes the drill an independent unit which can be installed wherever



NEW DESIGNS OF DRILLS DRIVEN BY MOTORS

desired without reference to line shafts. The motor is stopped and started by a switch convenient to the operator. Each drill has six speeds obtained through cone pulleys, giving a range of from 600 r.p.m. to 2400 r.p.m. The spindle has a ball thrust bearing. The drills are made by the Francis Reed Company, Worcester, Mass., and are driven by Westinghouse motors.

Industrial and Financial News

Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

Electric Drive for Pickle Works.—The plant of the Calumet Pickle Works at Hammond, Ind., has recently been remodeled and completely equipped with direct drive by motors. The Bell polyphase slow-speed motors for this installation were furnished by the Illinois Electric Company, of Chicago, Ill.

Connecticut Company Has Prosperous Year.—The past year has been for the Hart Manufacturing Company, of Hartford, Conn., the biggest and most prosperous in its history. At present all departments are running to full capacity. Among the largest installations of Diamond H switches and receptacles made recently in New York City were those in the Architects' Building and in the Biltmore Hotel.

Central-Station Energy for Dredgers.—The San Diego Consolidated Gas & Electric Company has made a contract with the city of San Diego to supply 1000 hp in electrical energy to operate a dredger to be used in excavating in the bay in connection with the municipal docks now under construction. The central-station company has supplied electricity for the operation of dredges in the bay for some time previous to the execution of this contract.

New Company Formed to Handle Public Utility Issues.—Effective Oct. 1, H. F. McConnell has withdrawn from the firm of Williams, McConnell & Coleman, of 60 Wall Street, New York, and formed a copartnership with W. F. Preston and F. W. Langhorst, former employees of the old organization, under the name of H. F. McConnell & Company, 25 Pine Street, New York, for the purpose of buying and selling investment securities, particularly public utility issues.

Allis-Chalmers Removal.—Supplementing a note in the Aug. 23 issue of the *Electrical World* on the plans of the Allis-Chalmers Manufacturing Company for moving its Chicago plant and offices to West Allis, Wis., word has come to the effect that on or before Oct. 6 the sales and engineering offices of the mining machinery department will be changed, followed in the near future by the shops. The advantages to be gained by concentrating all departments, both commercial and manufacturing, at one plant are given by the company as an explanation of this step.

Activity of a Boston Jobbing House.—The Stuart-Howland Company, of Boston, Mass., reports that in spite of the generally dull season it has enjoyed a substantial increase in its sales during this year. The company is making an effort to obtain greater efficiency and team work in its sales system, and to this end a dinner was given by it at the City Club in Boston on Sept. 26 to thirty-five members of the Eastern sales force. The dinner was served promptly at 6.15 o'clock, and after it a meeting was held, under the leadership of George H. Hahn, sales manager. Messrs. Stuart and McDonald, respectively president and secretary of the company, delivered addresses, as did several of the salesmen, and the meeting served to show that the company is receiving loyal and friendly co-operation from its sales force.

Oil Engines Sold for Electric Drive.—The De La Vergne Machine Company, of New York, is doing a good business in its line of oil engines and has recently sold two large engines of this type for electric-drive purposes. The first of these was one of 100-hp capacity which was sold to Doubleday, Page & Company for their new plant at Garden City, Long Island. This unit will be directly connected to a 240-volt Crocker-Wheeler generator, providing energy for lighting and power service. The second unit was sold to Sholtz & Atkinson, real estate agents, of Brooklyn, N. Y., who intend to use it at their property in Daytona, Fla. It will be belted to a direct-current generator for charging storage-battery cars, and also to a small generator of 5-kw capacity which will supply lighting current for the illumination of a bridge in that vicinity.

Electric Vehicle Situation in New York.—A new count has just recently been completed, showing the number of electric vehicles garaged and in operation on Manhattan Island to be 1944 (on Sept. 27). This includes both passenger and commercial cars, and as yet the statistics on the number of commercial cars in use are not available. The New York Railways Company, which several months ago ordered twenty-five electric trucks of various sizes from 1 ton up for use as emergency, repair and supply wagons, now has fifteen of these running. Among the novel electric trucks in operation in the city is a converted horse-drawn vehicle used by the National Fireproofing Company with good results. The front axle and wheels of this wagon were removed and replaced by the two-motor front-wheel drive made by the Couple Gear Company, of New York.

Large Steam Boiler Installation at the Plant of the Solvay Process Company.—Among a number of large boiler installations recently made by the Babcock & Wilcox Company, of 85 Liberty Street, New York, aggregating in capacity nearly 27,000 hp, the most notable was that made at the Syracuse (N. Y.) plant of the Solvay Process Company, where 11,365 hp in boilers was put in, together with superheater equipment. Several of the larger sales reported were to public utility companies, among them the United Illuminating Company, of Bridgeport, Conn., which purchased 1208 hp; the Trumbull Public Service Company, of Warren, Ohio, with 1206 hp, and the People's Gas & Electric Company, Mason City, Ia., to which 1004 hp in boilers was sold. The only foreign sale reported was 1236 hp of boiler equipment with bagasse burners, which went to the Ingenio Santa Gertrudis, of Cardenas, Cuba.

Tariff Bill Passes the House.—By a vote of 254 to 103 the new tariff measure passed the House of Representatives on Sept. 30. Few changes were made by the conference committee, and there is little doubt that the Senate will give its approval to the measure as it stands, while the President is reported to be pleased with the bill in its present form. The rates of particular interest to the electrical industry—namely, those on mica and on carbons—are as follows: Mica, value 15 cents per lb. or under, 4 cents per lb.; between 15 and 75 cents, 25 per cent.; over 75 cents per lb., 20 per cent.; cut mica, 30 per cent.; carbons, if made entirely from petroleum coke, 15 cents per 100 ft.; if made chiefly from lampblack or retort carbon, 40 cents per 100 ft.; carbons for flaming-arc lamps not especially provided for, 30 per cent. It is stated that English manufacturers expect to be greatly benefited by the general change of rates and that a number of them are getting ready to establish branch offices in this country in anticipation of a large increase in business. Discussing the new tariff measure, a representative of Dick, Kerr & Company, electrical engineers of Preston, England, who send machinery to all parts of the world, stated that as far as the electrical industry is concerned the revised rates will produce little increase of business.

A Good Export Trade in Heating Appliances Enjoyed.—The Hughes Electric Heating Company, of Chicago, Ill., is at present giving some attention to the development of a line of bakers' ovens electrically operated. One of the officials stated recently to an *Electrical World* representative that the company is doing a large business in the West and in Canada, having 900 of its electric ranges in operation in Winnipeg, Manitoba, and 600 in Billings, Mont. About one-third of the total sales were stated to be for export, and it was claimed that, because of the prevailing motor-service rates in most of the large Eastern and Central cities, the

company's sales in those cities amount to less than in some smaller municipalities in India and South Africa. The 3-cent rate obtaining in Boston, Mass., was stated to be the most favorable one in the East for the appliance trade.

Chicago Mail Order House Increasing Its Generating Equipment.—Because of the increasing demand for electrical energy during the winter months, and in order to provide reserve generating capacity, Sears, Roebuck & Company, the big Chicago mail order house, is installing a large turbo-generating unit. The generator is rated at 1500 kw, 220 volts, and wound for direct current. It will be driven by a non-condensing steam turbine of the horizontal type. A 500-hp Babcock & Wilcox boiler will be added to the steam generating equipment, and there is also being installed a steam-turbine-driven centrifugal boiler-feed pump which is capable of delivering 300 gal. per minute. The existing generating equipment consists of three 750-kw generators, one 500-kw machine and one 100-kw unit driven by reciprocating engines. The Westinghouse Electric & Manufacturing Company is installing the new generating unit. Martin C. Schwab, of Chicago, is consulting engineer for Sears, Roebuck & Company and A. F. Wright is chief engineer.

Mutual Protection Against Fraud.—The Electrical Protective League of Chicago held its annual meeting at the Chicago Athletic Club on Sept. 25. After dining together the members of the league listened to the report of a committee on the work which has been accomplished during the past year and elected a new board of directors which will hold office during the ensuing year. James Wolff presided at the meeting and Franklin Overbagh was the secretary. The Protective League was organized three years ago, and since that time has been influential in protecting manufacturers, jobbers and dealers in electrical apparatus against fictitious orders by following up any evidence which may lead to the recovery of stolen goods and by prosecuting those who have made a business of obtaining goods under false pretences. It employs the services of a detective agency and attorneys who prosecute the cases. The directors meet once a month or oftener and discuss methods of protection. The society is operated along the lines of a mutual insurance organization, each business house being assessed according to its yearly sales. No assessments are made except when money is required to investigate cases or to prosecute those where evidence has been obtained. Organizations similar to this one have been founded in other cities and have been effective in reducing losses due to theft or illegitimate orders. It is asserted by one of the representatives of a manufacturing house in Chicago that the loss due to these causes has been reduced in its territory about 85 per cent since the organization of the Protective League.

Work of the Geological Survey and Its Bearing on Electrical Engineering.—Some idea of the immense scope of its work and the bearing of this work, among other things, on the electrical engineering field is contained in a general report recently issued by the United States Geological Survey. This department of the government service, which occupies a pioneer position with respect to much of the material and industrial development of the country, is divided into three branches. The topographic corps has completed the mapping of contours over a large section of the United States and is each year adding to the folio. These maps are of large service in the preliminary work of laying out railway routes, roads and transmission lines, and they save to a large extent the time and money necessary in making reconnaissance surveys for special projects of this nature. The geologic corps is making an exhaustive study of the natural resources of the country. Fuels, metallic ores, chemical deposits and building materials are being located and classified and the information recorded so as to be available for reference in the building up of present and future industries. Another corps of engineers is busy with the study of the water resources of the country, investigating both underground and surface waters, determining their rate and volume of flow, their fitness for domestic use and irrigation, and their availability for power development. A very good idea of the importance of this work is given by the statement that more than 11,000,000 maps and reports are distributed each year in response to requests for information concerning the above subjects. About 25,000 inquiries per year are received from the General Land Office alone as to the character of lands which it is proposed to open for mining or agricultural purposes. In view of the large and increasing use of electricity for mining, manufacturing and agricultural power and for transportation on urban, interurban and main-line railways, carrying both passengers and freight, and also in view of the rapidly spreading network of wires for power, lighting and communication service, it is apparent that the work of the survey in opening up fields for this advance, while involving no large amount of electrical engineering in itself, is of paramount importance to that profession and to the electrical industry as a whole.

Addition to the American Can Company's Plant at Joliet, Ill.—The American Can Company has practically completed a new one-story brick addition to its factory at Joliet, Ill. This structure is built in the shape of a T with its main portion measuring 580 ft. by 200 ft. on the ground. The part of the building corresponding to the vertical part of the T measures 144 ft. by 34 ft. In this new factory building, which will supplement the old factory already in operation, all machinery will be electrically driven and electric illumination will be used. The motor equipment will be operated on direct current at 220 volts and the lighting will be done largely with 220-volt multiple tungsten lamps, although some Cooper Hewitt lamps are also to be used. The glue-heating pots and drying motors will serve as an additional electrical load. About 6000 sq. ft. of floor area will be devoted to the generating equipment. The generating room has been laid out so as to accommodate four steam-driven units, only two of which will be installed at present. One of these generators is rated at 150 kw and will be belt-driven; the other is a 60-kw machine and will be directly connected to its prime mover. These are both Allis-Chalmers generators and are wound for 220 volts, the steam engines being of the reciprocating type in each case. When the two additional units are added they will be driven in the same manner. A slate switchboard is also being installed which will be 6 ft. 8 in. high and 7 ft. 4 in. long. It consists of five panels, two of which will be generator panels. One will be used to distribute energy to the motors used in the new factory, one will distribute energy for lamps, and the fifth will be used to distribute energy to the older factory building. The panels are mounted on angle-iron frames fastened to channels in the concrete floor and braced from the wall. A two-wire circuit is being installed to connect the main power-feeder panel with fifteen sub-motor feeder panels at different places in the building. The main motor-feeder circuit consists of two 1,000,000-circ. mil cables ingeniously supported from brackets on I-beams and fastened to them by Minerallac clamps. Two No. 0000 cables connect the main lighting feeder panel with twelve lighting sub-feeder panels placed at convenient distributing points throughout the building. Four or five cabinets are supplied with energy direct from the main switchboard. Steam will be supplied by a battery of four water-tube boilers equipped with Jones underfeed stokers. Henry Newgard & Company, of Chicago, have the wiring contract.

NEW YORK METAL MARKET PRICES

	Sept. 22 Bid.	Sept. 22 Asked.	Sept. 29 Bid.	Sept. 29 Asked.
Copper:				
Standard, spot*	....	....	....	....
	Selling Prices		Selling Prices	
	£ s d		£ s d	
London, standard, spot*	72 15 0		72 10 0	
Prime Lake	16.75	.....	16.75	.....
Electrolytic	16.50	to 16.62½	16.40	to 16.60
Casting	16.37½	to 16.50	16.30	to 16.40
Copper wire base	17.75	to 18.00	17.75	.....
Lead	4.75		4.75	
Nickel	40.00	to 45.00	40.00	to 45.00
Sheet zinc, f. o. b. smelter	8.00		8.00	
Spelter, spot	5.80	.....	5.65	to 5.70
Tin, spot	41.50	to 41.87½	41.40	to 41.60
Aluminum:				
Prompt delivery	21.50	to 22.50	21.50	to 22.50
Future	....	.....	....	.....

*OLD METALS

Heavy copper and wire	15.00	15.00
Brass, heavy	9.75	9.75
Brass, light	8.50	8.50
Lead, heavy	4.65	4.65
Zinc, scrap	4.75	4.75

*COPPER EXPORTS

Total tons to Sept. 29 30,132

*From daily transactions on the New York Metal Exchange.

Corporate and Financial

Western United Gas & Electric Company Bonds.—The Western United Gas & Electric Company has sold $1,000,000 of 6 per cent general mortgage bonds to Chicago bankers, and these are being offered to the public on a 6 per cent interest basis.

Atlantic Gas & Electric Company Earnings.—The Atlantic Gas & Electric Company, which owns several operating properties, has issued a report for the year ended July 31, 1913. It shows a consolidated income of subsidiary gas and electric properties amounting to $1,117,539. The net surplus from the subsidiary companies, constituting income resources held available for the Atlantic Gas & Electric Company, amounted to $208,643. Other income aggregated $65,497, making a total of $274,140. Expenses were $28,415, leaving a net income of $245,725. Interest was $100,000, and preferred dividends amounted to $105,000, leaving a surplus of $40,725.

Improvements in Philadelphia.—It is reported in Philadelphia that the Philadelphia Electric Company will issue a call for an additional payment of $5 per share on its stock, and that at the same time a special dividend of $1.50 per share will be declared, with the object of reducing the net payment on the assessment to $3.50 per share. This plan would make the total payment on the stock of the company $22.50. The par value per share is $25. The company is planning important improvements if its negotiations with the Pennsylvania Railroad for power to be used in connection with the proposed electrification in the suburban district are carried through.

Development in Stockton, Cal.—The California Railroad Commission has approved the request of the Western States Gas & Electric Company to issue $354,000 bonds. This company is a subsidiary of the Standard Gas & Electric Company, and is managed by H. M. Byllesby & Company. Proceeds of the bonds will pay for improvements and additions already made, principally to the gas and electric property at Stockton. During the year ended Aug. 1, 1913, the Stockton company's number of electric customers increased 1678, or 29 per cent; power business connected increased 4664 hp, or 40 per cent, and the number of gas customers increased 686, or 12 per cent.

Pacific Gas & Electric Company Matters.—The Pacific Gas & Electric Company has started court action against the Secretary of Agriculture and officers of the Forestry Division to enjoin them from interfering with work in the Tahoe National Forest, which is a part of the Lake Spaulding project. The position of the company is that it has procured rights from the State and that the matter is not under the jurisdiction of the national government. At a meeting of stockholders on Sept. 12 the issue of $7,000,000 of one-year 6 per cent notes was authorized. Of this issue $4,500,000 have been sold to Harris, Forbes & Company and N. W. Halsey & Company, of New York. The notes will be secured by $5,000,000 general and refunding 5 per cent bonds and $5,000,000 general lien 6 per cent bonds.

Indianapolis Company Bonds.—An issue of $325,000 refunding mortgage 5 per cent ten-year gold bonds of the Merchants' Heat & Light Company of Indianapolis has been sold by Harris, Forbes & Company, New York. The bonds were issued in connection with $250,000 stock as consideration for the property of the People's Heat & Light Company. The gross earnings of the combined properties during the fiscal year ended July 31, 1913, were $722,303; operating expenses and taxes were $403,853, leaving net earnings of $318,450. Interest on the outstanding bonds amounted to $143,000, leaving a surplus of $175,450. The company has recently surrendered its franchise and accepted an indeterminate permit of the State. It states that the similar indeterminate permit law existing in Wisconsin has proved more satisfactory than a municipal grant.

Readjustment of British Westinghouse Company.—Plans for the readjustment of the British Westinghouse Company have been issued in London. It is proposed to reduce the capital from £1,875,000 to £1,150,000. The £3 preference shares will be written down £1 per share, and the £5 ordinary shares will be reduced £3 per share. Of the £725,000 of capital to be extinguished in this manner, £225,000 will be devoted to the writing down of patents and good will to a value of £150,000, while the remaining £500,000, together with the balance at the credit of the profit and loss account, will be used to depreciate other assets, to write off expenses in connection with the issue of prior lien debentures and the loss of £52,049 sustained in connection with the litigation with the Underground Electric Railways. It is proposed to increase the rate of dividend on the preference shares from 10 per cent to 15 per cent and on the ordinary shares from 12 per cent to 30 per cent.

Virginian Power Company Bonds.—An issue of $1,250,000 of first lien 6 per cent gold notes of the Virginian Power Company is offered by A. B. Leach & Company, New York. The notes are offered at a net interest yield of 7 per cent. They are dated Aug. 1, 1913, and are due Feb. 1, 1915, but are redeemable at any time at par and interest. The purchaser of each $1,000 note will receive as a bonus one $100 share of common stock and also rights to subscribe to $1,000 of first and collateral trust mortgage 5 per cent bonds at the underwriting price, with, in case of such subscription, an additional bonus of one share of common stock with each $1,000 bond so taken. The company is erecting a steam power station at Cabin Creek Junction, W. Va., of 26,666-hp capacity and transmission lines in the Kanawha-New River coal fields. It has acquired the physical properties and water rights of the Dominion Power Company of West Virginia and owns all the outstanding stock of the Dominion Power Company of Virginia and of the New River Power Company of West Virginia. The bonds are secured by a deposit of $2,500,000 first and collateral trust mortgage 5 per cent bonds and by other securities. The estimated annual income from contracts now signed is $298,300. Contracts are under negotiation for $187,000, indicating an estimated income of $485,300.

Mr. Insull and Associates Acquire People's Gas Company.—Much attention was aroused in financial circles, as indicated in the *Electrical World* of Sept. 20, by the announcement that Mr. Samuel Insull, president of the Commonwealth Edison Company of Chicago, and his associates had secured a large interest in the stock of the People's Gas Light & Coke Company of that city. Three new members of the board of directors of the gas company have been elected. They are Mr. Insull, Mr. John J. Mitchell, president of the Illinois Trust & Savings Bank, and Mr. James A. Patten, capitalist and formerly prominent on the Chicago Board of Trade. Mr. Insull, Mr. Mitchell and Mr. Patten are directors of the Commonwealth Edison Company. They constitute a majority of the directors of the People's Gas Light & Coke Company, and Mr. Insull has been made chairman of the board of directors of that company. Mr. James F. Meagher, formerly vice-president and long the chief legal adviser of the company, has been made president of the People's Gas Light & Coke Company. The remaining director is Mr. E. G. Cowdery, vice-president and operating head of the company. The official announcement of the change is in part as follows: "This completes a transaction that brings home to Chicago one of its leading enterprises, which will in future be managed and directed by Chicago men. Mr. Insull stated that the present situation had come about consequent upon the death of Anthony N. Brady and the desire of C. K. G. Billings to withdraw from a management he had so long and so successfully held. The changes made are entirely friendly and the result of negotiations between Mr. Billings and Mr. Insull, and they are peculiarly appropriate in view of the very large proportion of the company's stock that is now owned by residents of Chicago and vicinity. The next quarterly dividend on People's Gas stock will be at the rate of 8 per cent per annum. It is the intention to call a special meeting of the stockholders to increase the authorized capital stock of the company from $35,000,000 to $50,000,000 and to offer to stockholders toward the close of the year 10 per cent additional stock at par. It should be said the transaction in no way, shape or manner involves a consolidation or merger with the Commonwealth Edison Company, either directly or by means of a holding company or association of any sort, nor the creation of any such company or association."

Business Notes

The Best Manufacturing Company, not the Best Engineering Company, as stated in the Sept. 20 issue, was deprived of its president when George Best resigned to organize another company.

The R. Thomas & Sons Company, because of the increase in its business, has been forced to remove to larger quarters. The company's office address remains, however, as before, Old Colony Building, Chicago, Ill.

Kilbourne & Clark Manufacturing Company.—The Kilbourne & Clark Manufacturing Company, engineer and manufacturer of electrical apparatus, has moved from 407 First Avenue, South, to 71 Columbia Street, Seattle, Wash.

The Lighting Studios Company, formerly at 16 West Thirty-third Street, New York, has removed its offices and showroom to 132 Madison Avenue. This company is busy on some unusual designs for interior and exterior lighting glassware.

Lockwood, Greene & Company, 60 Federal Street, Boston, architects and engineers for industrial plants, have established a Canadian office under the name of Lockwood, Greene & Company of Canada, Ltd., with headquarters in the McGill Building, Montreal.

Moore & Clarke, patent trade-mark and copyright attorneys, announce the establishment of their partnership and of offices at 2 Rector Street, New York, and in the Barrister Building, Washington, D. C. The firm is made up of Edward B. Moore, former United States Commissioner of Patents, and H. H. C. Clarke, a member of the United States Supreme Court bar.

Verne W. Shear, formerly associated with the Westinghouse Electric & Manufacturing Company and the Northern Ohio Traction & Light Company, is now established as commercial engineer and manufacturers' agent with offices at 609 Flatiron Building, Akron, Ohio. The Condit Electrical Manufacturing Company and the Pittsburgh Transformer Company are among the firms represented.

New Industrial Companies

The Utility Electrical Signal Company, of Kittery, Maine, has been incorporated with a capital stock of $100,000 to manufacture and deal in electrical signals. Horace Mitchell is president and H. A. Paul treasurer.

The Petschel Storage Battery Company, of Chicago, Ill., has been incorporated with a capital stock of $75,000 by H. T. Scarrett, N. E. Cole and R. T. Jefferson, of Chicago, Ill. The company proposes to manufacture electrical supplies.

The Johnson Electric Appliance Company, of Chicago, Ill., has been incorporated by H. B. Johnson, T. B. Dockson and J. F. Williams, of Chicago, Ill. The company is capitalized at $25,000 and proposes to manufacture electric appliances.

The G. & W. Electric Specialty Company, of Chicago, Ill., has been granted a charter with a capital stock of $250,000 for the purpose of manufacturing electric specialties. The incorporators are: H. T. Haines, W. G. Colvin and R. F. Carter, of Chicago.

Trade Publications

Motors.—Polyphase motors are fully described and illustrated in Bulletin No. 102 of the Wagner Electric Manufacturing Company, St. Louis, Mo.

Clay Products.—In a folder recently issued by the Laclede-Christy Clay Products Company, Manchester and Sulphur Avenues, St. Louis, Mo., are some pertinent paragraphs relating to its clay products.

Vacuum Cleaners.—The Federal Sign System (Electric), Lake and Desplaines Streets, Chicago, gives a brief talk on the Federal vacuum cleaner in a small folder recently distributed, emphasizing its special features.

Valves.—Jenkins Brothers, 80 White Street, New York, in a large four-page folder illustrate many types of valves. Sectional views of their brass-globe valve and iron-body globe valve are shown, and a general description is given.

Electrical Specialties.—Attachment plugs, rosettes, receptacles and other devices are illustrated and briefly described in Bulletin No. 5, recently issued by the Tregoning Electric Manufacturing Company, Cleveland, Ohio. A discount sheet is included.

Paint.—The United States Gutta Percha Paint Company, Providence, R. I., in a pamphlet entitled 'Claims Versus Tests," gives a report of the test of its mill-white paint made at the Electrical Testing Laboratories, together with two testimonial letters from satisfied users of Rice's Mill White.

Plugs.—The Yost "Lockfast" plug is effectively illustrated and described in a booklet recently published by the Yost Electric Manufacturing Company, Toledo, Ohio. The new and distinctive features of this device are set forth clearly, and the simplicity and ease of operation are graphically shown.

Elevators.—The Otis Elevator Company, 17 Battery Place, New York, has published a series of booklets on its various types of elevators. These pamphlets are well printed and attractively illustrated, and are inclosed within dignified covers. They relate to traction elevators, inclined elevators, residence elevators, escalators and inclined railways, a separate publication being devoted to each subject.

Lamp Coloring.—In a little four-page folder the Wesco Supply Company, St. Louis, Mo., refers to its new brand of lamp coloring for outdoor use—Cefco—a weatherproof coloring which, it is claimed, will not chip, blister or wash off during the life of any lamp outdoors. This brand is made in six colorings. The Wesco brand of coloring for use on indoor lamps is also referred to, and prices are given.

Motors.—"Electricity in the Manufacture of Jewelry" forms the subject of Circular 30,701 issued by the Holtzer-Cabot Electric Company, Boston, Mass. It contains an interesting talk on the practical advantages of electric drive in the jewelry industry, based on results from actual experience. Some excellent illustrations fittingly illustrate the text. Motor-driven polishing benches, buffing and grinding motors, scratch brushes, hot-blast drying apparatus and other motor-driven devices used in the jewelry industry are illustrated.

Control Apparatus in Chicago.—The Cutler-Hammer Manufacturing Company, Milwaukee, has published an attractive eighty-page brochure whose title, "Cutler-Hammer Control in Chicago," only partially suggests its interesting contents. The booklet was published as a souvenir of the 1913 N. E. L. A. convention, but its contents are of permanent interest. The object of the book was to illustrate some of the notable buildings of Chicago and to show how many of the buildings there are equipped with C-H controllers. A "Handy Guide" to the business section of Chicago makes a useful supplement.

Thirty-fifth Edition of "Steam."—The Babcock & Wilcox Company, 85 Liberty Street, New York, has issued the thirty-fifth edition of "Steam: Its Generation and Use." This is a handsomely printed 336-page publication, size 10¼ by 7¼ in., and differs much from the ordinary trade catalog. It is arranged in the manner of a textbook and contains material and data of much value. Beginning with the early history of the generation and use of steam, the reader's interest is sustained throughout the entire work by the practical, interesting and well-arranged information, lavishly and excellently illustrated. The subject matter is comprehensively treated.

Boiler Performance.—The engineering department of the Edge Moor Iron Company, Edge Moor, Del., has published, as Bulletin 51, a report of tests of a steam boiler at high rates of evaporation made at the Westport generating station of the Consolidated Gas, Electric Light & Power Company of Baltimore. The pamphlet contains within its fourteen pages the results of three tests made on a 736-hp. Edge Moor water-tube boiler at different rates of evaporation. One of these tests was at 318 per cent load. The bulletin will interest managers of lighting plants who have to consider problems of providing for peak loads. A complete record of the results is given.

Personal Mention

Mr. Lamar Lyndon, of New York, has been retained by the city of Houston, Tex., as its electrical expert.

Mr. D. F. Finn has been elected electric-light commissioner of Norwich, Conn., for a term of three years.

Mr. G. K. Dustin has resigned as general manager of the Columbia (S. C.) Railway, Gas & Electric Company.

Mr. A. R. Happoldt has been appointed manager of the Central Illinois Utilities Company property at Milford, Ill.

Mr. O. W. Watson has been appointed superintendent of the Leicester plant of the Worcester (Mass.) Electric Light Company.

Mr. E. M. Westhoven has been appointed superintendent of the Woodlake station of the Mount Whitney Power & Electric Company of Visalia, Cal.

Mr. Robert E. Hughes, former president of the Kentucky Electric Company, of Louisville, is touring the Orient with his wife and daughter. He is at present in Japan.

Mr. E. F. Putnam, commercial manager of the United Electric Light & Water Company, of Greenwich, Conn., has also been appointed contract agent of the Norwalk division for the company.

Mr. Stanley H. Mosher, manager of the Leitchfield (Ky.) Light, Heat & Power Company, has been transferred to Petersburg, Ind., where he will take charge of the McCaskey properties.

Mr. W. H. Rolinson, who has been for some years chief lamp inspector of the Electrical Testing Laboratories, has accepted the position of commercial engineer with the Westinghouse Lamp Company.

Mr. G. A. Cook, of Milwaukee, has been appointed local manager of the Kenosha plant of the Wisconsin Gas & Electric Company, succeeding Mr. P. E. Cowles, who has been transferred to Racine.

Mr. Gano Dunn, president of the J. G. White Engineering Corporation and past-president of the American Institute of Electrical Engineers, has been elected a member of the Simplified Spelling Board.

President C. O. Mailloux of the American Institute of Electrical Engineers has been honored by the President of France, who has conferred upon him the decoration of Chevalier of the Legion of Honor.

Mr. P. E. Cowles, manager of the Kenosha plant of the Wisconsin Gas & Electric Company, has been transferred to the Racine plant, where he will have charge of the electrical department as successor to Mr. Weiss, who recently resigned.

Mr. L. H. Provine, formerly superintendent of construction of the Stone & Webster Engineering Corporation at Seattle, Wash., and recently in charge of its Los Angeles (Cal.) office, has been appointed professor of architectural engineering at the University of Illinois.

Mr. Franklin Thomas, for the past year connected with the Alabama Power Company, Birmingham, Ala., and previously a member of the teaching staff of the University of Michigan, has been appointed instructor in civil engineering at the Throop College of Technology, Pasadena, Cal.

Mr. M. Webb Offutt, formerly manager of the Schenectady Illuminating Company, Schenectady, N. Y., and more recently with the Electric Bond & Share Company, has resigned as assistant to the vice-president and general manager of the Alabama Power Company, of Birmingham, Ala.

Mr. L. J. Hanna, formerly in charge of the new-business department of the Kentucky Electric Company, of Louisville, is now acting manager of the corresponding department of the Louisville Gas & Electric Company, formed by the merger of the Kentucky Electric Company, the Louisville Lighting Company and other concerns.

Mr. A. R. Knight, until recently instructor in electrical engineering at the University of Pennsylvania, has been appointed instructor in electrical engineering at the University of Illinois. Mr. Knight is a graduate of the Ohio State University and for a time was engaged in practical work with the Columbus (Ohio) Public Service Company, the Dayton (Ohio) Lighting Company and the Springfield (Ohio) Light, Heat & Power Company.

Mr. P. S. Biegler has been appointed associate professor in electrical engineering in the University of Illinois. Mr. Biegler, who is a graduate of the University of Wisconsin, was for two years connected with the Commonwealth Edison Company and served as an assistant to the electrical engineer of the Washington Water Power Company. He was assistant professor of electrical engineering at Purdue University in 1910-1911, and until his present appointment was professor of electrical engineering at the University of Montana.

Mr. W. W. Freeman, for many years vice-president and general manager of the Edison Electric Illuminating Company of Brooklyn, has severed his connections with the Sperlings of London and resigned as vice-president and general manager of the Alabama Traction, Light & Power Company, Ltd., of Birmingham, Ala., to become associated with Messrs. A. B. Leach & Company, bankers, of New York. Mr. Freeman will become vice-president of the Columbia Gas & Electric Company and associated companies operating in Cincinnati, Ohio.

Mr. Edward J. Nally, until recently vice-president and general manager of the Postal Telegraph & Cable Company, has been appointed vice-president and general manager of the Marconi Wireless Telegraph Company of America. Mr. Nally has been connected with the telegraph business for more than thirty-five years, starting with the Western Union Telegraph Company and afterward entering the service of the Postal Telegraph & Cable Company, with which he has been connected for nearly twenty-five years. Mr. Nally sailed for England on the *Mauretania* on Oct. 1 to familiarize himself with the details of the wireless business abroad.

Mr. Thomas H. Arnold, formerly electrical engineer for the Southwestern Portland Cement Company, of El Paso, Tex., has accepted the position of district engineer in the Lehigh Cement district for Sellers & Rippey, consulting engineers, Philadelphia, Pa. Mr. Arnold will open an office in Allentown and take active charge for Sellers & Rippey of their work in cement-mill electrification. Mr. Arnold was graduated from Pennsylvania State College in 1905 and since that time has had a wide experience in mill electrification under widely differing conditions. He has worked as operator for the Northern California Power Company, as superintendent of the Pass Power & Lighting Company at Frank, Alberta; as assistant electrical engineer for the Nevada Consolidated Copper Company in the construction of the Steptoe Valley concentrator and smelter at McGill, Nev., and as electrical engineer for the Southwestern Portand Cement Company at El Paso, Tex. While with the latter company Mr. Arnold carried through considerable experimental work toward perfecting electrical apparatus for operation under cement-mill conditions.

Dr. Rudolph Diesel, inventor of the Diesel oil engine, mysteriously disappeared from an English Channel steamer on Sept. 29, while on his way to attend the business meeting of the Diesel company in London. When the steamship reached Harwich Dr. Diesel was missing, and it is conjectured that he fell overboard between Antwerp and that place. Dr. Diesel was born in Paris in 1858 and was educated there, in Augsburg, Germany, and at the Polyclinic College in Munich, where he was much interested in thermodynamics. After obtaining some practical experience in Switzerland, Dr. Diesel went to Paris as a consulting engineer. Ever since he left college he had been experimenting with the internal-combustion type of engine. His publication of the pamphlet "Theory and Construction of a Rational Heat Motor" was not very well received, but the Augsburg Machine Company and A. Krupp arranged to give him a free hand in carrying out his ideas. He built an engine in 1893, but this model never worked. In 1898 he exhibited his first commercial engine, and at present his engines are largely employed in Europe and in marine work.

Construction

New England

BIDDEFORD, MAINE.—We are informed that the Pepperell Mfg Co. does not contemplate the construction of a power plant at Union Falls for some years at least. The company was reported in the issue of Sept. 27 to be planning the construction of a concrete dam at Union Falls.

ISLAND POND, VT.—The Island El. Co. expects to make some changes in its waterwheel equipment during the coming year. J. S. Sweeney is manager.

ROWLEY, MASS.—The electric-light commission expects to purchase within the next 12 months meters, lightning arresters, incandescent lamps, etc.; also electrical appliances and supplies, including heating and cooking apparatus, vacuum cleaners, washing machines, wiring supplies, etc., within the next two months. S. O. Kent is manager of the municipal electric-light plant.

NEW BRITAIN, CONN.—D. McMillan, Main Street, is reported to be contemplating the installation of an electric generating plant to furnish energy for lamps and motors for his block on Main Street.

Middle Atlantic

BROOKLYN, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, corner Park Avenue and Fifty-ninth Street, New York, until Oct. 6, for installing electric equipment in the Bay Ridge High School on Fourth Avenue, between Sixty-seventh and Senator Streets. Blank forms, plans and specifications may be obtained or seen at the above office, and also at the branch office, 131 Livingston Street, borough of Brooklyn.

CORNING, N. Y.—The Corning Lt. & Pwr. Corpn. has been granted permission by the Public Service Commission to issue $400,000 in capital stock and $100,000 in 10-year debentures, the proceeds to be used to acquire the property and franchises of the Corning Gas & El. Co. and to make extensions and improvements to its property.

ESSEX, N. Y.—The Bouquet El. Pwr. Co., of Essex, expects to purchase within the next few months cross-arms, braces, through-bolt washers, etc. F. W. Barber is manager.

LYONS, N. Y.—The Board of Village Trustees has entered into a contract with the Central New York Gas & El. Co. for lighting the streets of the village for a period of five years. Under the terms of the new contract the company will furnish 11 new flame-arc lamps, 15 five-lamp clusters and 130 single lamps scattered throughout the village. The new lamps are to be installed by Nov. 1.

MIDDLETOWN, N. Y.—Merchants on North Street are contemplating the installation of ornamental lamp standards. Stanley Millspaugh is getting data on posts and would be glad to receive catalogs, prices, etc. The street-lighting service is furnished by the Orange County Ltg. Co. Laurent Heaton is manager of the company.

NEW YORK, N. Y.—Bids will be received by the commissioner of bridges, Department of Bridges, Municipal Building, New York, until Oct. 9, for furnishing and installing lighting fixtures in the municipal building. Blank forms and specifications may be obtained at the above office. Arthur J. O'Keeffe is commissioner of bridges.

NIAGARA FALLS, N. Y.—A final report on the cost of the installation of a municipal electric-light plant has been submitted to the Business Men's Association by Horace G. Sweet, electrical engineer, of Utica, N. Y., which states that a plant could be installed for $65,000.

WEST STOCKHOLM, N. Y.—George N. Gibson & Son, owners of the local electric-light plant, expect to purchase next season a 50-hp waterwheel to operate under a 10-ft. head.

EASTON, PA.—The Eastern Pennsylvania Pwr. Co., of Easton, is reported to be preparing plans for alterations and additions to several of its large power plants.

PHILADELPHIA, PA.—The Department of Public Works will receive bids until Oct. 6 for furnishing illumination next year for 20,000 street lamps now lighted by gasoline. The bids will be strictly for illumination irrespective of the source of light to be used. The city's gasoline lighting bill for this year represents about $550,000. No bids were offered under the new specifications last month.

PHILADELPHIA, PA.—Bids will be received by George W. Norris, director, at the office of the Department of Wharves, Docks and Ferries, 555 Bourse Building, Philadelphia, Pa., until Oct. 6 as follows: Schedule A—For the installation of an electric lighting and power system at Dock Street pier, Delaware River; Schedule B—for installation of wharf drop mechanism at Dock Street pier; Schedule C—for repairs to Reed Street bulkhead, Delaware River. Plans, specifications and blank forms can be obtained at the above office.

WELLSBORO, PA.—The Wellsboro El. Co. is contemplating the purchase of one 300-hp water-tube boiler. W. S. Culver is superintendent.

CAMDEN, N. J.—The United El. Construction Co., of Philadelphia, Pa., has been awarded the contract for the electrical equipment for the plant of the Armstrong Cork Co., of Camden, at $15,000.

CUMBERLAND, MD.—The City Council has instructed the electric light and water commissioner to engage an engineer to make investigations relative to the installation of a municipal electric light and power plant.

WHEELING, W. VA.—The Wheeling Valley Lt. & Pwr. Co., which was recently granted a franchise by the County Commissioners to erect transmission lines through the Wheeling district, will erect a power station at Woodsdale, a suburb of Wheeling. Details have not yet been decided upon. C. E. Bedill, of Wheeling, is engineer in charge.

CHARLOTTESVILLE, VA.—The Redland Lumber Co., it is reported, contemplates the installation of an electric-light plant in Charlottesville.

HOUSTON, VA.—The Houston El. Lt. Co. is erecting a large flour mill to be operated in connection with and by energy generated by its electric plant. To meet the extra demand for energy the company will soon install another generator; other improvements will be made in the near future, including the construction of a new concrete dam. L. M. Thayer is manager.

WASHINGTON, D. C.—The contract for furnishing lighting fixtures for the new building of the Bureau of Engraving and Printing has been awarded to C. A. Muddiman & Co., of Washington, D. C., for $17,895.

WASHINGTON, D. C.—Bids will be received at the office of the Coast and Geodetic Survey, No. 205 New Jersey Avenue S. E., Washington, D. C., until Oct. 11, for an electric freight elevator in the Richards Building, in accordance with specifications, copies of which may be obtained by addressing the superintendent of Coast and Geodetic Survey, Washington, D. C.

WASHINGTON BARRACKS, D. C.—Bids will be received by the Engineer Depot, United States Army, Washington, D. C., until Oct. 8 for furnishing 13 direct-current switchboards, etc. For further information address Lt. Col. Joseph E. Kuhn.

North Central

ATHENS, MICH.—The Athens Mill & Pwr. Co. has recently installed a 50-hp kerosene engine to use in case of emergency in connection with its water-power. The Village Council and the merchants are considering the installation of an ornamental street-lighting system in the business district. E. K. Mason is secretary and manager.

BANGOR, MICH.—The managers of the municipal electric-light plant expect to purchase within the next few months wiring supplies, etc., as the village will carry supplies and do the wiring in connection with the municipal plant, beginning at once. P. M. Gross is superintendent.

DETROIT, MICH.—The Public Lighting Commission has authorized the installation of 70 new street lamps in the Seventeenth Ward. The commissioners, it is said, are contemplating replacing the present arc lamps with tungsten lamps throughout the city in the near future.

HOUGHTON, MICH.—The Houghton County El. Lt. Co. is constructing a transmission line to Dollar Bay to furnish energy to the new wire mill projected by John A. Roebling's Sons Co. The Houghton company has recently completed the erection of a line to the Superior mine location and will supply electricity for lighting the residences there.

STURGIS, MICH.—The Board of Public Works expects to purchase within the next six months 30 ornamental lamp standards. Single lamps and five-lamp clusters are under consideration. J. S. Flanders is manager.

TECUMSEH, MICH.—The Tecumseh El. Co. is extending its lines to Britton to furnish energy for lamps and motors. The company has been awarded a contract for street lighting in Britton, consisting of ten 100-watt tungsten lamps.

CLEVELAND, OHIO.—The Supreme Court has dismissed an injunction brought by W. H. Drum, of Cleveland, to restrain the city from issuing $1,000,000 in bonds for the installation of a municipal electric-light plant. Under the ruling the city can now proceed with the bond issue and the construction of the plant.

MANTUA, OHIO.—The Mantua Lt., Ht. & Pwr. Co. is contemplating purchasing energy from an outside source. E. P. Williams is secretary.

WARREN, OHIO.—The Trumbull Pub. Ser. Co., of Warren, expects to purchase within the next six months a full line of electrical appliances, including heating and cooking apparatus, vacuum cleaners, washing machines, etc. George Dougherty is manager.

CLOVERPORT, KY.—The Cloverport Ice Co. is installing an electric-light plant in connection with its ice plant to furnish energy for lamps and industrial purposes. The equipment will consist of two 60-hp horizontal tubular boilers, manufactured by the Henry Vogt Mch. Co., of Louisville (with provision for additional installation as needed); one 160-hp non-condensing Erie Victor engine directly connected to a 100-kva, three-phase, 60-cycle, 2300-volt Fairbanks-Morse generator; 210 30-ft. poles and 115,000 ft. of wire will be used in connection with the distribution system. The street-lighting system will consist of 52 200-cp, 4-amp lamps, 15 of which will be cable suspension, the rest gooseneck suspension. The company will carry a complete line of fixtures and electrical supplies. Ira D. Behen, of Cloverport, is engineer in charge of the work. A. A. Simons is president of the company.

FORT BRANCH, IND.—The Fort Branch El. Lt. & Pwr. Co. has filed articles of incorporation changing its name to the El. Lt. Co. of

Fort Branch. The company is capitalized at $20,000. The street-lighting system will be changed over to series tungsten in October, for which materials have already been purchased. Homer T. Genung is secretary and manager.

GOSHEN, IND.—The Goshen Lt. & Pwr. Co. has purchased a site near Slate Hill cemetery on which it will erect a transformer station. George Krom is superintendent.

EVANSTON, ILL.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Oct. 31 for the extension and remodeling, etc., including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Evanston, Ill. Drawings and specifications may be obtained from the above office or from the custodian at Evanston. O. Wenderoth is supervising architect.

GENEVA, ILL.—Steps have been taken by the merchants and property owners on West State Stret for the installation of an ornamental street-lighting system.

NAUVOO, ILL.—The Nauvoo El. Lt. & Pwr. Co. has closed a contract with the Mississippi River Pwr. Co. for energy from the Keokuk plant. An entire new plant will be built at a cost of $14,000. The town will be rewired and a new street-lighting system installed. John Nelson, Sr., is president and manager of the Nauvoo El. Lt. & Pwr. Co.

STERLING, ILL.—The Rock River Lt. & Pwr. Co., of Sterling, which is building a new power plant on the government dam in Sterling, has contracted with the Illinois Northern Utilities Co., of Chicago, for the entire output. The company is now installing five 560-hp Allis-Chalmers waterwheels, three waterwheel governors, five 469-kva Allis-Chalmers (umbrella-type) generators, a nine-panel Allis-Chalmers switchboard for alternating-current, 60 cycles. H. S. Green is general manager.

ELLSWORTH, WIS.—The electric plants of the Ellsworth Ht., Lt. & Pwr. Co. are reported to have been purchased by the Chippewa Valley Ry., Lt. & Pwr. Co., of Eau Claire. The deal includes the steam plant in Ellsworth and the one on Rush River. Both plants will be discontinued and a transmission line will be erected from Ellsworth to Hartland, which will connect with the Menomonie-Red Wing line. Right-of-way, it is understood, has already been purchased.

MAUSTON, WIS.—The Mauston El. Ser. Co. expects to purchase within the next six months a boiler and engine with possibly a rating of 150 hp. H. F. Schroeder is secretary.

MENOMONEE FALLS, WIS.—The Menomonee Falls El. Lt. Co. expects to purchase within the next three months one 35-kw generator. J. A. Pratt is secretary.

MERRILL, WIS.—The Merrill Ry. & Ltg. Co. expects to purchase within the next few months 50 or more lightning arresters. E. S. King is secretary.

PRAIRIE DU CHIEN, WIS.—The Prairie City El. Co., of Prairie du Chien, expects to erect within the next 30 days a new power house (fireproof) and a 125-ft. concrete stack. L. F. Haupt is superintendent.

SUPERIOR, WIS.—The United Steel Corpn. is planning the erection of a new steel plant at the head of the lakes, involving an expenditure of $30,000,000. The first unit, it is said, will be completed within a year. Water-power from the St. Louis River will be developed to generate electrical energy for the proposed plant. The company will use the recently invented electric process in the manufacture of steel at this plant.

BIRD ISLAND, MINN.—The Central Minnesota Lt. & Pwr. Co., of Glencoe, will install an ornamental street-lighting system in Bird Island, consisting of 20 ornamental lamp standards carrying one 60-watt lamp and four 40-watt lamps, 2200 ft. of curb three-wire conductor, either armored cable or conduit work. Bids for the work have already been received. H. B. Rutledge, of Glencoe, is president of the company.

MINNEAPOLIS, MINN.—The City Council has authorized the construction of a municipal street-car line to extend from Thirty-seventh Avenue northeast to the filtration plant, work on which is to begin immediately. The cost is estimated at $26,000.

BAGLEY, IA.—The City Council has engaged W. H. Grover, of Ames, Ia., to take charge of the engineering work in connection with the proposed municipal electric-light plant, for which $6,000 in bonds were recently voted.

DUBUQUE, IA.—The Union El. Co., of Dubuque, has awarded the contract for construction of power house to Anton Zwack, of Dubuque. The building is to be of reinforced construction and to cost about $30,000.

STRAWBERRY POINT, IA.—Contracts have recently been awarded to the Minneapolis Steel & Machinery Co. for one 65-hp Munzel producer-gas engine and one 100-hp gas producer, to the Fort Wayne El. Works for one 40-kw, 220-volt generator with switchboard, all to be installed during the month of October. A. Steil is superintendent.

ALBANY, MO.—Bids will be received by the city of Albany until Oct. 7 for construction of new power plant. Plans and specifications may be obtained from Rollins & Westover, Midland Building, Kansas City, Mo. W. E. Noonan is superintendent.

ELMO, MO.—At an election held recently the proposition to make arrangements with the Lee El. Co., of Clarinda, Ia., for the installation of an electric-light system in Elmo was carried.

JEFFERSON CITY, MO.—Bids will be received at the office of the State Capitol Commission Board, Jefferson City, Mo., until Nov. 18 for the construction, including mechanical equipment, of the Missouri State Capitol at Jefferson City, in accordance with drawings and specifications, copies of which may be obtained at the above office or at the office of Tracy & Swartwout, architects, 244 Fifth Avenue, New York, N. Y. J. Kelly Pool is secretary of board.

KANSAS CITY, MO.—The Kansas City El. Lt. Co., it is reported, will take over the management of the electric light plants in the R. A. Long Building, the Bryant Building, the Hall Building, the Taylor Building and other buildings having their own electric generating plants.

MONROE CITY, MO.—The managers of the municipal electric light plant expect to erect within the next two months an extension to the engine and boiler room and 1½ miles of transmission line to the pumping station, and also to install an engine, boiler and two generators (one of 100 kw and one of 60 kw). All material and equipment has been purchased. O. R. Emerson is superintendent.

SEDALIA, MO.—The City Lt. & Trac. Co., it is reported, contemplates the erection of an addition to its Broadway power house and the installation of a 400-hp boiler.

DONIPHAN, NEB.—Plans have been completed whereby energy to light the village of Doniphan will be secured from the plant of the Grand Island El. Co., of Grand Island. The company will erect a transmission line from its plant to the village, which will be distributed by the Doniphan El. Lt. & Pwr. Co., recently incorporated with a capital stock of $10,000. Charles T. Young, B. F. Scudder and C. A. Stone are interested in the company.

ONAGA, KAN.—The capital stock of the Onaga Lt., Ht. & Pwr. Co. has been increased from $6,500 to $10,000.

PRATT, KAN.—Bonds to the amount of $50,000 have been voted for the installation of a municipal electric-light plant. Electrical service in Pratt is now furnished by a private company.

WHITING, KAN.—The city of Whiting is erecting a 10-mile transmission line to secure energy to operate the municipal electric-light system. Henrici, Kent & Low, of Kansas City, Mo., are engineers in charge of the work. F. G. Todd is city clerk.

Southern States

CHARLOTTE, N. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Nov. 1 for alterations, new roof, floors, etc., including mechanical equipment, interior lighting fixtures and approaches, in the present assay office building in Charlotte, N. C. Drawings and specifications may be obtained from the above office or from the custodian at Charlotte. O. Wenderoth is supervising architect.

HENDERSONVILLE, N. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Nov. 15 for the construction complete, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Hendersonville, N. C. Drawings and specifications may be obtained from the above office or from the custodian of site. O. Wenderoth is supervising architect.

MONROE, N. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Nov. 7 for construction, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office in Monroe. Drawings and specifications may be obtained at the above office or from the custodian of site at Monroe. O. Wenderoth is supervising architect.

WASHINGTON, N. C.—The managers of the municipal electric-light plant expect to purchase within the next four months three 150-hp water-tube boilers, one 360-kva, 60-cycle, three-phase, 2300-volt turbo-generator unit; one 40-kw motor-generator exciter, one 40-kw turbo-generator exciter, one surface condenser with air pump, one six-panel switchboard to control two generators, three feeder circuits and two exciters. H. B. Charles is superintendent.

WALHALLA, S. C.—The Linler Pwr. Co., recently incorporated with a capital stock of $40,000, proposes to construct a dam and power house at old Mauldin Mill Shoals, 7½ miles from Walhalla. John J. Linler, of Walhalla, and Marcellus E. Thornton, of Hickory, N. C., are interested in the company.

PLAINS, GA.—The Town Council is considering the question of installing an electric-light plant and water-works system in Plains.

AUBURNDALE, FLA.—The installation of an electric-light plant in Auburndale is reported to be under consideration.

HIGH SPRINGS, FLA.—Bonds to the amount of $35,000 have been voted for the installation of a municipal electric-light plant and water-works system in High Springs.

LAFAYETTE, LA.—Improvements are contemplated to the municipal electric-light plant, involving an expenditure from $7,000 to $10,000.

DARLINGTON, OKLA.—Arrangements are being made to install an electric-light and power system at the Masonic Orphans' Home near Darlington. It is proposed to erect a pole line to maintain a four-wire, two-phase, 60-cycle system. Energy is to be transmitted from the generating station at El Reno, 4½ miles distant.

GRANDFIELD, OKLA.—J. A. Brabham and L. E. Edwars, who were recently granted a franchise to construct and operate an electric-light system in Grandfield, are now installing a plant.

TULSA, OKLA.—Plans are being considered, it is reported, by the Tulsa Corpn. for increasing the output of its electric plant. Sargent & Lundy, Jackson and Michigan Boulevards, Chicago, Ill., are consulting engineers.

WATONGA, OKLA.—The Board of Light Commissioners expects to purchase within the next 30 days one Corliss engine and within the next two months one carload of poles, lightning arresters and wire for extension line. A triplex motor-driven pump is now being installed at the plant. Bonds to the amount of $35,000 have been voted for improvements in city. O. W. Hunt is superintendent of municipal electric plant.

BLOOMINGTON, TEX.—The installation of an electric-light plant and water-works system in Bloomington is under consideration. The Commercial Club is promoting the project.

BROWNWOOD, TEX.—The City Council is considering the question of installing a municipal electric-light plant.

GOLIAD, TEX.—The Goliad Supply Co. has just completed the installation of a 60-hp Snow crude-oil engine and a 37½-kw General Electric generator, changing from steam to an oil-burning engine. Edward F. Glaize is owner and manager.

HONESDALE, TEX.—The Honesdale Lt., Ht. & Pwr. Co. has recently purchased a 26-lamp Pittsburgh series incandescent lighting system for lighting Texas Township, adjoining this borough. F. H. Eisele is superintendent.

MISSION, TEX.—The construction of a municipal electric-light plant is contemplated by the city of Mission.

MOODY, TEX.—The Home Lt. & Pwr. Co. expects to erect a transmission line from Eddy, Tex., and secure energy from the plant of the Texas Pwr. & Lt. Co. within the next 12 months; also to purchase wire, poles, transformers, lamps, etc. The company proposes to change its system from direct current to alternating current as soon as possible and rewire the whole town. C. Canuteson is owner and manager.

QUANAH, TEX.—A new 130-hp Snow crude-oil engine has recently been installed in the plant of the Quanah light and ice works. E. A. Clousnitzer is owner and manager.

ROYSE CITY, TEX.—The Royse Milling & Lt. Co. expects to make improvements to its system within the next three months. Details have not yet been decided upon. A. Hurst is manager.

TEMPLE, TEX.—The Southwestern Trac. Co., of Temple, will soon file an amendment to its charter with the Secretary of State increasing its capital stock to $3,500,000, the proceeds to be used for extending the railway from Temple to Waco, a distance of about 30 miles, and from Temple south to Austin, about 80 miles. A. F. Bentley is president.

TYLER, TEX.—The Tyler Pwr. & Lt. Co. is installing new machinery in its plant here, preparatory to furnishing energy to operate the local street railway system. The entire North Bois d'Arc line is being rebuilt now, poles and wire being erected.

Pacific States

BELLINGHAM, WASH.—Preparations are being made by the Puget Sound Trac. Lt. & Pwr. Co. of Seattle to extend its transmission lines into Skagit and La Connor valleys for the purpose of furnishing the smaller towns and farmers with energy for lamps and motors.

CHEHALIS, WASH.—The Washington-Oregon Corpn. has recently filed with the county auditor of Thurston a mortgage to the amount of $1,000,000 to secure a bond issue. Of the proceeds of the bond issue, $300,000 will be used in making extensions to its various properties in Washington and Oregon, consisting of steam-heating plants, power plants, street railways and water systems, located in Chehalis, Centralia, Tenino, Vancouver, Wash., and other cities. The company is contemplating the construction of an electric railway from Vancouver, Wash., to Olympia and Seattle, via Tacoma.

SEATTLE, WASH.—The Stimson Mill Co., of Ballard, has submitted a proposition to the City Council offering to furnish the city with energy to the amount of from 8000 kw to 10,000 kw (continuous service) for the municipal electric-light plant. The City Council is now considering a proposition to secure energy from the Tacoma municipal electric plant. J. D. Ross is superintendent.

SPOKANE, WASH.—The Washington Wtr. Pwr. Co., it is reported, has made arrangements to erect a 60,000-volt transmission line from Spokane into the towns of Wilbur, Creston, Hartline and Almira.

GLADSTONE, ORE.—Plans have been submitted to the City Council by the Gladstone Commercial Club for the installation of an ornamental street-lighting system. General improvements to the entire lighting system are also recommended.

MEDFORD, ORE.—The California-Oregon Pwr. Co., of Medford, expects to change within the next two months all voltage of its lines from Grant's Pass, Ore., to Dunsmuir, Cal., from 20,000 volts to 34,000 volts. H. C. Stoddard is superintendent.

STAYTON, ORE.—The West Stayton Pwr. & Ry. Co., of Stayton, recently incorporated, is planning to erect a power plant on the north fork of the Santiam River, near Stayton, to furnish energy for lamps, industrial purposes and street railway. Estimates are now being received by the company on equipment for proposed plant, including waterwheels, waterwheel governors, generators, switchboard equipment, transformers, material for distribution system meters, arc lamps, incandescent lamps, etc. S. N. Arnold, Wilcox Building, Portland, is engineer in charge of the work. The office of the company is located at 418 Yeon Building, Portland.

VALE, ORE.—The Vale Lt. & Wtr. Co. expects to erect within the next 30 days a 300-kw transformer station. A 24-hour service will be established upon connection with the transmission line of the Beaver River Pwr. Co., of Boise, Idaho. E. A. Boyd is superintendent.

LOS ANGELES, CAL.——The Southern California Edison Co., of Los Angeles, has been granted a permit by Secretary Houston of the Department of Agriculture for the development of additional hydroelectric power in the Kern national forest. The permit covers four water-power sites, from which it is estimated that 33,000 hp can be developed. The projects will involve the construction of four dams and considerable conduit work, power plants and high-tension transmission lines, etc.

RED BLUFF, CAL.—A permit has been signed by Secretary Houston of the Department of Agriculture giving the Sierra El. Pwr. Co. permission to develop the water-power in the Lassen national forest on Mill Creek, 25 miles east of Red Bluff. The work includes the construction of a conduit, 16 miles long, to a concrete power house capable of developing 23,500 kw. The headquarters of the company is in Oakland.

SAN DIEGO, CAL.—Sealed proposals will be received by the Board of Supervisors at the Court House, San Diego, addressed to J. T. Butler, county clerk, until Oct. 10, for constructing nurses' dormitories at the County Hospital in said county, including wiring and electric-light fixtures and steam heating. Plans and specifications are on file at the office of the Board of Supervisors.

SANTA CRUZ, CAL.—The Coast Counties Gas & El. Co., of Santa Cruz, has applied to the State Railroad Commission for permission to issue $200,000 in capital stock, the proceeds to be used for additions and improvements to its plant.

COEUR D'ALENE, IDAHO.—The City Council has authorized the city attorney to prepare the necessary petition to be presented to the State Utilities Commission for establishing municipal electric light and water plants. The City Council favors the purchase of the existing plants, provided they can be purchased at a reasonable price.

HAMILTON, NEV.—Preparations, it is reported, are being made by the Hamilton Pwr. Mining & Transportation Co. for the erection of a power plant on Illipah Creek, about 6½ miles from Hamilton, to furnish energy in Hamilton and to the White Pine mining district. The cost of the plant is estimated at about $30,000.

Canada

GODERICH, ONT.—The municipality has purchased 60 Jandus Luxolabra three-lamp and one-lamp standards, which will be erected around Court House Park.

KINGSTON, ONT.—The City Council will again ask the Hydro-Electric Power Commission to submit estimates of cost of furnishing energy to operate the municipal electric system.

LONDON, ONT.—The City Council has passed a by-law approving the equipping of the London & Port Stanley Railway for electrical operation, to be submitted to the ratepayers for approval.

Miscellaneous

ILOILO, PHILIPPINE ISLANDS.—The Iloilo El. Co. expects to purchase within the next six months one 250-hp or 300-hp internal combustion boiler. The company has recently completed the installation of a 250-kw, three-phase, 60-cycle, 2300-volt alternator directly connected to a 12-in. by 24-in. by 36-in. cross-compound Hamilton Corliss engine. R. R. Landon is president and manager.

New Incorporations

LOS ANGELES, CAL.—The Beardsley El. Co. has been granted a charter with a capital stock of $100,000. The incorporators are: L. Goldwater, M. Elsasser, M. Cohn, W. L. Moreland, C. H. Sorg, J. T. Shannon and V. S. Beardsley.

LEBANON JUNCTION, KY.—The Lebanon Junction Lt. & Pwr. Co. has been incorporated with a capital stock of $4.500 by C. McL. Stinger, R. M. Hocker and G. W. Bache.

WALHALLA, S. C.—The Linler Pwr. Co. has been granted a charter with a capital stock of $40,000 to build a dam and power plant at the old Maudlin Mills Shoals.

MEMPHIS, TENN.—The Southern El. Co. has been incorporated with a capital stock of $5,000 by John B. Vesey, G. S. Spruggs, C. E. Weeks, W. W. Yates and P. H. Phelan, Jr.

MINERAL WELLS, TEX.—The Mineral Wells El. Co. has been incorporated with a capital stock of $65,000 by Percy Jones, W. E. Kaufman and D. T. Bemar.

Directory of Electrical Associations, Societies, Etc.

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, H. O. Hanson, Mobile Gas Co., Mobile, Ala.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. Permanent secretary, L. O. Howard, Smithsonian Institution, Washington, D. C.

AMERICAN ELECTRIC RAILWAY ACCOUNTANTS' ASSOCIATION. Secretary-treasurer, Matthew R. Boylan, Public Service Railway Co., Newark, N. J. Annual convention, Atlantic City, N. J., Oct. 13-17.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, H. C. Donecker, 29 West 39th St., New York. Annual convention, Atlantic City, N. J., Oct. 13-17.

AMERICAN ELECTRIC RAILWAY ENGINEERING ASSOCIATION. Secretary, H. C. Donecker, 29 West 39th St., New York. Annual convention, Atlantic City, N. J., Oct. 13-17.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION. Secretary, Dr. J. Willard Travell, 27 East 11th St., New York.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS. Secretary, Eugene W. Stern, 101 Park Ave., New York City.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson, 33 West 39th St., New York. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country.

AMERICAN PHYSICAL SOCIETY. Secretary, Prof. A. D. Cole, Ohio State University, Columbus, Ohio. Annual meeting, Atlanta, Ga., December.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary-treasurer, Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS. Secretary, Edwin A. Scott, 29 West 39th St., New York.

AMERICAN WATER WORKS ASSOCIATION. Secretary, J. M. Diven, 47 State St., Troy, N. Y. Annual meeting, May, 1914.

ARKANSAS ASSOCIATION OF PUBLIC UTILITY OPERATORS. Secretary, W. J. Tharp, Little Rock, Ark. Annual meeting, May, 1914.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, Geo. C. Holberton, Pacific Gas & Electric Co., San Francisco, Cal.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, W. T. Snyder, McKeesport, Pa.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary-treasurer, Jos. A. Andreucetti, Chicago & Northwestern Railway, Chicago. Annual meeting, Chicago, Oct. 20-24.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, P. W. Drew, 112 West Adams St., Chicago. Annual meeting, New Orleans, May 19-22, 1914.

CALIFORNIA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, W. S. Hanbridge, 1408 Merchants' National Bank Building, Los Angeles, Cal.

CANADIAN ELECTRICAL ASSOCIATION. Secretary, H. G. Martin, Toronto Electric Light Co., Ltd., Toronto, Can.

COLORADO ELECTRIC CLUB. Secretary, C. F. Oehlmann. Meets every Thursday at Albany Hotel, Denver, Col. Annual meeting, Denver, Oct. 6.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary, Thomas F. Kennedy, 900 15th St., Denver, Col. Annual meeting, Denver, Oct. 6.

ELECTRIC CLUB OF CHICAGO. Secretary, Fred M. Rosseland, Monadnock Block, Chicago. Meets every Thursday noon at Hotel Sherman.

ELECTRICAL CONTRACTORS' ASSOCIATION OF GREATER BOSTON. Secretary, R. S. Hale, 39 Boylston St., Boston.

ELECTRICAL CONTRACTORS' ASSOCIATION OF MASSACHUSETTS. Secretary, H. D. Temple, 30 Foster St., Worcester, Mass.

ELECTRICAL CONTRACTORS' ASSOCIATION OF NEW YORK STATE. Secretary, Geo. W. Russell, Jr., 25 West 42d St., New York.

ELECTRICAL CONTRACTORS' ASSOCIATION OF THE CITY OF CHICAGO. Secretary, M. N. Blumenthal, 179 West Washington Street. Meets at noon on the second and fourth Wednesday of each month at 424 South Wabash Ave.

ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary, Ernest S. Cowie, 1613 Grand Ave., Kansas City, Mo.

ELECTRICAL CONTRACTORS' ASSOCIATION OF WISCONSIN. Secretary, Albert Peterman, 626 Lloyd St., Milwaukee, Wis.

ELECTRICAL CREDIT ASSOCIATION OF CHICAGO. Secretary, Frederick P. Vose, 1343 Marquette Building, Chicago. Annual meeting, Chicago, November.

ELECTRICAL CREDIT ASSOCIATION OF PHILADELPHIA. Secretary, John W. Crum, 1324 Land Title Building, Philadelphia, Pa..

ELECTRICAL SALESMEN'S ASSOCIATION. Secretary, Francis Raymond, 125 Michigan Ave., Chicago, Ill.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. General secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill. Next meeting, Hot Springs, Va., Nov. 18-20.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Can.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliott, Harding Building, 34 Ellis St., San Francisco, Cal. Meeting, San Francisco, second Thursday of each month.

ELECTRIC VEHICLE ASSOCIATION OF AMERICA. Secretary, Harvey Robinson, 124 West 42d Street, New York. Annual convention, Chicago, Oct. 27 and 28.

ELECTRIC VEHICLE ASSOCIATION OF AMERICA, NEW ENGLAND SECTION. Secretary, L. L. Edgar, 39 Boylston St., Boston.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, 29 West 39th St., New York.

FARADAY ELECTRICAL ASSOCIATION. Secretary, W. J. Collins, 1129 Masonic Temple, Chicago. Meets at noon on the first and third Wednesday of each month at Planters' Hotel.

GAS, ELECTRIC AND STREET RAILWAY ASSOCIATION OF OKLAHOMA. Secretary-treasurer, Prof. H. V. Bozell, Norman, Okla. Annual meeting, May, 1914.

ILLINOIS STATE ELECTRICAL ASSOCIATION. Secretary, H. E. Chubbuck, Peoria, Ill.

ILLUMINATING ENGINEERING SOCIETY. General secretary, J. D. Israel, Engineering Societies Building, 29 West 39th St., New York. Sections in New York, New England, Philadelphia, Chicago and Pittsburgh.

INDEPENDENT ELECTRICAL CONTRACTORS' ASSOCIATION OF GREATER NEW YORK. Secretary, A. Newburger, 1153 Myrtle Ave., Brooklyn, N. Y.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary and treasurer, J. V. Zartman, 49 Lombard Building, Indianapolis, Ind.

INSTITUTE OF OPERATING ENGINEERS. Secretary, L. Houmiller, 29 West 39th St., New York.

INSTITUTE OF RADIO ENGINEERS. Secretary, E. J. Simon, 81 New St., New York. Annual meeting, New York, January, 1914.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex.

INTERNAL-COMBUSTION ENGINEERS' ASSOCIATION. President, Charles Kratsch, 416 West Indiana St., Chicago. Meeting second Friday of each month at Lewis Institute.

INTERNATIONAL ELECTRICAL CONGRESS. Secretary, Dr. E. B. Rosa, Bureau of Standards, Washington, D. C. San Francisco, Sept. 13-18, 1915.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England. Meeting at San Francisco, Sept. 6-11, 1915.

IOWA ELECTRICAL ASSOCIATION. Affiliated with N. E. L. A. Secretary, H. B. Maynard, Waterloo, Ia.

IOWA STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, H. E. Weeks, Davenport, Ia. Annual meeting, Cedar Rapids, April 23, 1914.

JOVIAN ORDER. Jupiter (president), F. E. Watts, 239 West 39th St., New York; Mercury (secretary), E. C. Bennett, St. Louis, Mo. Annual meeting, Hotel Astor, New York, Oct. 14-16.

KANSAS GAS, WATER, ELECTRIC LIGHT AND STREET RAILWAY ASSOCIATION. Secretary-treasurer, Ivor Thomas, 237 South Main St., Wichita, Kan. Annual convention, Hutchinson, Oct. 9 and 10.

LOUISIANA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, W. H. Bower Spangenberg, 625 Poydras St., New Orleans, La. Meets second Thursday of each month.

MAINE ELECTRIC ASSOCIATION. Secretary-treasurer, Walter S. Wyman, Waterville, Maine.

MINNESOTA ELECTRIC ASSOCIATION. Secretary-treasurer, F. A. Otto, St. Paul Gas Light Company, St. Paul, Minn. Annual meeting, Minneapolis, March, 1914.

MISSISSIPPI ELECTRIC ASSOCIATION (affiliated with the National Electric Light Association). Secretary-treasurer, Frank J. Duffy, Natchez, Miss.

MISSOURI ELECTRIC, GAS, STREET RAILWAY AND WATER WORKS ASSOCIATION. Secretary-treasurer, F. D. Beardslee, Union Electric Light & Power Co., St. Louis. Annual meeting, May, 1914.

NATIONAL ARM, PIN AND BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary-treasurer, Wm. L. Smith, Concord, Mass.

NATIONAL DISTRICT HEATING ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive secretary, T. C. Martin, Engineering Societies Building, 33 West 39th St., New York. Annual meeting, Philadelphia, May, 1914.

NATIONAL ELECTRIC LIGHT ASSOCIATION, COMMERCIAL SECTION. Secretary, J. F. Becker, 1170 Broadway, N. Y.

NATIONAL ELECTRIC LIGHT ASSOCIATION, EASTERN NEW YORK SECTION. Secretary, C. S. Van Dyck, Schenectady, N. Y.

NATIONAL ELECTRIC LIGHT ASSOCIATION, HYDROELECTRIC SECTION. Secretary, S. A. Sewall, 29 West 39th St., New York.

NATIONAL ELECTRIC LIGHT ASSOCIATION, MICHIGAN SECTION. Secretary, Herbert Silvester, 18 Washington Boulevard, Detroit, Mich.

NATIONAL ELECTRIC LIGHT ASSOCIATION, NEBRASKA SECTION. Secretary-treasurer, S. J. Bell, David City, Neb.

National Electric Light Association, New England Section. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass.

National Electric Light Association, Northwest Section. Secretary, N. W. Brockett, Pioneer Building, Seattle, Wash.

National Electric Light Association, Southeastern Section. Secretary-treasurer, A. A. Wilbur, Columbus, Ga.

National Electrical Contractors' Association of the United States. Secretary, George H. Duffield, 41 Martin Building, Utica, N. Y.

National Electrical Credit Association. Secretary, Frederic P. Vose, 1343 Marquette Building, Chicago. Annual meeting, June, 1914.

National Fire Protection Association. Secretary of electrical committee, Ralph Sweetland, 141 Milk Street, Boston, Mass. Open meeting, New York, March, 1915.

National Independent Telephone Association. Secretary-treasurer, Richard Valentine, Janesville, Wis.

New England Electrical Credit Association. Secretary, Alton F. Tupper, 60 State St., Boston, Mass. Directors meet first Wednesday of each month.

New England Street Railway Club. Secretary, H. A. Faulkner, 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

New Orleans Electrical Contractors' Association. Secretary, S. J. Stewart, 312 Carondelet St., New Orleans, La. Meetings, second and fourth Tuesday of each month.

New York Electric Railway Association. Secretary, Charles C. Dietz, 598 Broadway, Albany, N. Y.

New York Electrical Credit Association (affiliated with the National Electrical Credit Association). Secretary, Franz Neilson, 80 Wall St., New York. Annual meeting, Dec. 9.

New York Electrical Society. Secretary, G. H. Guy, 33 West 39th St., New York. Annual meeting, New York, June, 1914.

Northwestern Cedarmen's Association. Secretary, N. E. Boucher, 743 Lumber Exchange, Minneapolis, Minn. Annual meeting, Jan. 6, 1914.

Ohio Electric Light Association. Secretary, D. L. Gaskill, Greenville, Ohio.

Ohio Society of Mechanical, Electrical and Steam Engineers. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus, Ohio. Annual meeting, Columbus, Ohio, Nov. 20-22.

Oregon Electrical Contractors' Association. Secretary, F. C. Green, 291 East Morrison St., Portland, Ore. Annual meeting, April, 1914.

Pennsylvania Electric Association (State Section N. E. L. A.). Secretary-treasurer, S. C. Pohe, Bloomsburg, Pa.

Railway Signal Association. Secretary, C. E. Rosenberg, Bethlehem, Pa. Annual convention, Nashville, Tenn., Oct. 14-17.

Society for Electrical Development, Inc. Acting secretary-treasurer, Stephen L. Coles, 29 West 39th St., New York.

Society for the Promotion of Engineering Education. Secretary, Prof. H. H. Norris, Ithaca, N. Y. Annual meeting, Princeton, N. J., June, 1914.

Southwestern Electrical and Gas Association. Secretary, H. S. Cooper, 405 Slaughter Building, Dallas, Tex.

Vermont Electrical Association. Secretary-treasurer, A. B. Marsden, Manchester, Vt.

Western Association of Electrical Inspectors. Secretary, W. S. Boyd, 76 West Monroe St., Chicago, Ill. Annual meeting, Cincinnati, Jan. 27-29.

Western Society of Engineers, Electrical Section. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago.

Wisconsin Electrical Association. Secretary, George Allison, Stephenson Building, Milwaukee, Wis. Annual meeting, Jan. 15 and 16, 1914.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED SEPT. 23, 1913.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

1,073,589. TELEPHONE-EXCHANGE SYSTEM; S. H. Browne, Pittsburgh, Pa. App. filed Aug. 29, 1904. Calls are automatically distributed upon the switchboard so that each operator gets as many calls as she can well handle.

1,073,596. ELECTRIC CABLE; H. C. Egerton, Ridgewood, N. J. App. filed Feb. 9, 1911. Loading coils inserted in cable in accordance with Pupin system.

1,073,598. SYSTEM OF ELECTRIC-CURRENT DISTRIBUTION; C. Le G. Fortescue, Pittsburgh, Pa. App. filed Nov. 16, 1911. Transformers, etc., in multiple-circuit relation receive distribution of current according to their several capacities.

1,073,601. ELECTRIC BATTERY; W. S. Gould, New York, N. Y. App. filed March 27, 1912. Sealed storage-battery cell for submarines in which the plates may be easily removed in small units.

1,073,619. ELECTRIC FUSE; T. E. Murray, Jr., New York, N. Y. App. filed April 22, 1912. Fuse strip in U-form with a body of refractory insulating material disposed between the arms of said strip.

1,073,632. ELECTRICAL MEASURING INSTRUMENT; L. T. Robinson and O. Holz, Schenectady, N. Y. App. filed Sept. 30, 1909. For determining relation between the impressed voltage and the current in an alternating-current circuit to indicate thereby the power-factor.

1,073,643. BRUSH HOLDER FOR DYNAMOS; H. S. Steinhart, Stuttgart, Germany. App. filed Aug. 13, 1912. Combined brush holder and conductor clamp.

1,073,662. MEANS FOR CONTROLLING SYNCHRONOUS MACHINES; J. Burke, Erie, Pa. App. filed Sept. 20, 1907. For starting, bringing up to synchronous speed and maintaining machine in synchronism.

1,073,667. TELEPHONE TRANSMITTER; H. C. Egerton, Passaic, N. J. App. filed Oct. 5, 1912. Movable electrode mounted direct on transmitter diaphragm.

1,073,670. STRAP OR CONNECTION FOR SECONDARY OR STORAGE BATTERIES; B. Ford, Philadelphia, Pa. App. filed Jan. 25, 1911. Leaden-coated copper strips, provided with perforated ends and massive leaden heads applied to such ends.

1,073,675. MEANS FOR REGULATING RECEPTOR CLOCKS; G. A. Goodson, Minneapolis, Minn. App. filed Oct. 17, 1910. Regulation by Hertzian waves.

1,073,677. PRIMARY BATTERY CELL; J. H. Gugler and G. W. Colles, Milwaukee, Wis. App. filed July 22, 1910. Uses solution of chlorate as depolarizer.

1,073,680. SEMAPHORE SIGNAL; L. A. Hawkins, Schenectady, N. Y. App. filed April 6, 1910. Electric motor geared to semaphore arm is driven backward to act as braking generator when arm falls.

1,073,684. ELECTRIC FURNACE; J. Hess, Vienna, Austria-Hungary. App. filed Nov. 20, 1911. Gas delivery and charge supply are united in one chamber immediately around the electrode or electrodes.

1,073,692. CURRENT-TRANSMITTING INSTRUMENT; C. D. Lanning, Boston, Mass. App. filed June 5, 1907. Repeating instrument of granular microphone type; prevents packing of granules between the electrodes.

1,073,708. RECEIVER HOLDER FOR TELEPHONES; H. C. Raiber, Pittsburgh, Pa. App. filed Oct. 19, 1912. Upstanding connected receiver, holding arms pivoted to pedestal of telephone instrument.

1,073,748. SYSTEM FOR DIVIDING CALLS AMONG TELEPHONE OPERATORS' POSITIONS; H. J. W. Fay, Westboro, Mass., and E. C. Molina, East Orange, N. J. App. filed Oct. 12, 1907. Automatic finding switches for picking out idle cord circuits.

1,073,753. GALVANIC BATTERY; J. Haigh, Muskogee, Okla. App. filed Aug. 9, 1912. Has metal cylindrical electrode and cylindrical carbon arranged concentrically.

1,073,788. TELEPHONE OUTFIT FOR THE DEAF; K. M. Turner, Jamaica, N. Y. App. filed May 25, 1912. Outfit contained in a handbag.

1,073,792. PNEUMATO-ELECTRIC PIANO-PLAYER; G. Buechner and H. Semrau, Schenectady, N. Y. App. filed Aug. 16, 1912. Diaphragm-controlled circuit contacts.

1,073,823. DEVICE FOR SYNTHESIZING GASES; W. Siebert, Rheinfelden, Germany. App. filed April 9, 1909. Electric flame discharge furnace in which the gases are introduced tangentially.

1,073,863. MEANS FOR SELECTIVE SIGNALING; I. F. Manny, Milwaukee, Wis. App. filed Oct. 27, 1911. Signal may be given to one or more of a number of substations without signaling other stations on the same circuit.

1,073,868. ELECTROLYTIC APPARATUS; M. Perreur-Lloyd, Boulogne-sur-Seine, France. App. filed March 28, 1911. Anodes of circular rotary disks and cathode plates suspended between the anodes.

1,073,870. DEVICE FOR SYNTHESIZING GASES; W. Siebert, Rheinfelden, Germany. App. filed April 9, 1909. Flame discharges of double cone form are produced between two rod-shaped electrodes.

1,073,886. TELEGRAPHY; W. M. Bruce, Jr., Springfield, Ohio. App. filed Aug. 24, 1912. For long-distance telegraphy, uses alternating current and provides means for absorbing the alternations without interfering with the make-and-break impulses.

1,073,926. ELECTRICALLY HEATED GARMENT; A. Pollak, Paris, France. App. filed March 12, 1912. Flexible conductors of low resistance and small cross-section arranged in parallel groups in garment, such as glove.

1,073,935. ELECTRIC SWITCH; F. Schneider, Cleveland, Ohio. App. filed Feb. 13, 1911. For portable electric tools.

1,073,955. ATTACHMENT-PLUG FITTING; F. V. Burton, Bridgeport, Conn. App. filed Dec. 3, 1912. Attachment plug has latching elements to be engaged in different positions by co-operating latch elements on an independent outlet member.

1,074,003. ALARM ATTACHMENT FOR DOORS AND WINDOWS; T. L. McGovern and F. W. Allen, San Francisco, Cal. App. filed March 14, 1912. Burglar alarm rings continuously on opening and closing of door.

1,074,068. ELECTROMAGNETIC ORE SEPARATOR; G. Rietkötter, Hagen, Germany. App. filed Oct. 30, 1912. Stationary magnet system with inclosing revolving drum.

1,074,071. MAKE-AND-BREAK MECHANISM; H. A. Tepel, Jeffersonville, Ind. App. filed June 30, 1911. Fluid conductor switch for trolley wires.

1,074,088. ELECTRODE-SUPPORTING ROD FOR ELECTROLYTIC TANKS; P. Jensen, Perth Amboy, N. J. App. filed April 9, 1913. Rod of twisted angular stock to provide plurality of spiral contact edges.

13,618 (reissue). ARC LAMP; T. L. Carbone, Charlottenburg, Germany. App. filed Feb. 19, 1913 (original patent 975,935, Nov. 15, 1910); globe for flaming arcs of inverted conical shape to prevent condensation of gases on the walls of the chamber.

13,619 (reissue). ARC LAMP; T. L. Carbone, Charlottenburg, Germany. App. filed May 15, 1913 (original patent 975,935, Nov. 15, 1910); process to prevent condensation of vapors on the globe of a flaming-arc lamp.